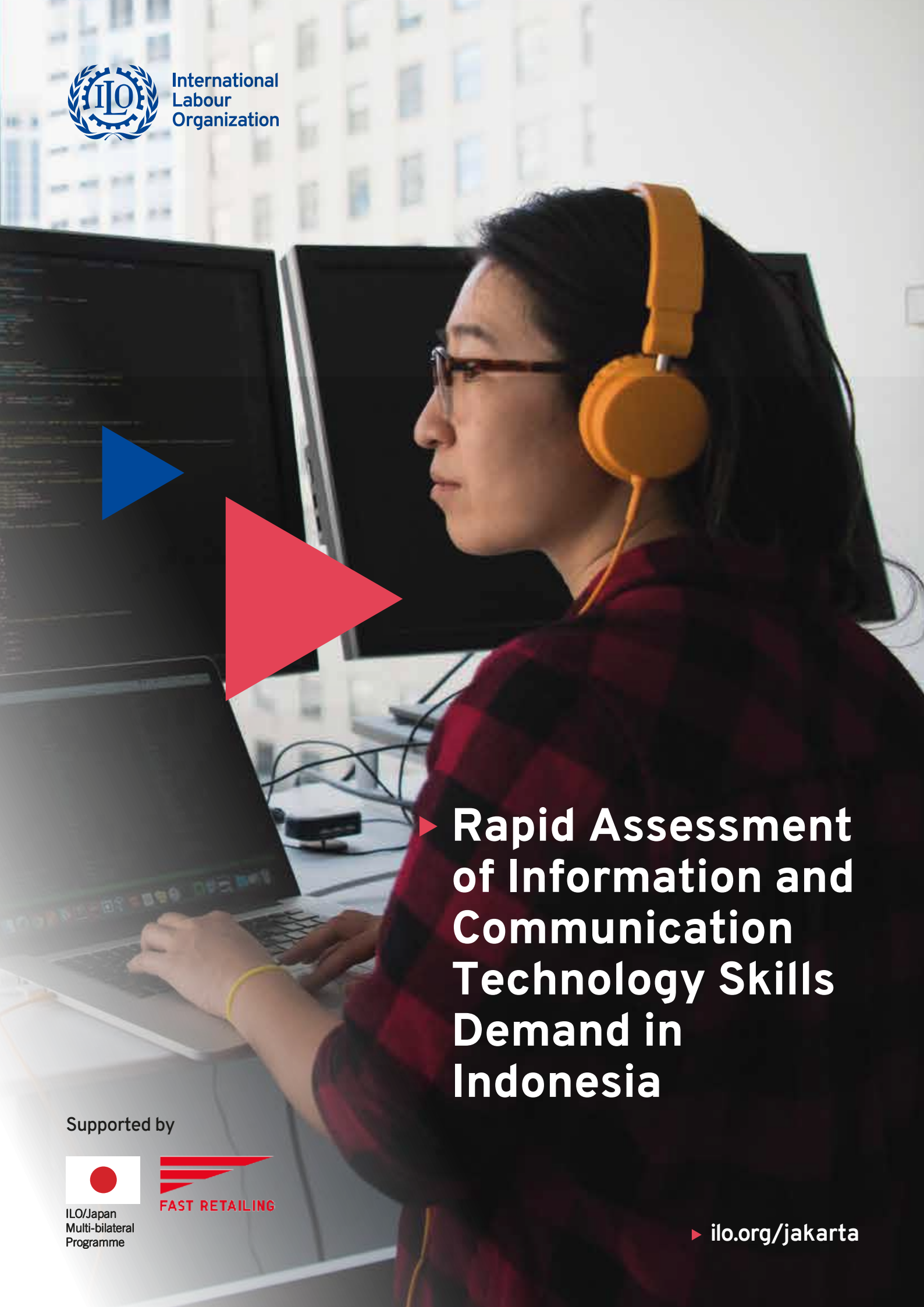

International Labour Organization

Rapid Assessment of Information and Communication Technology Skills Demand in Indonesia

Supported by

ILO/Japan Multi-bilateral Programme

FAST RETAILING

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Rapid assessment of information and communication technology skills demand in Indonesia

Cornelia Hirania Wiryasti
Janti Gunawan
Tauvik Muhamad

International Labour Organization (ILO) Country Office for Indonesia and Timor Leste

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The authors wish to express their gratitude to the Government of Japan through the ILO/Japan-funded Project on Industry Skills for Inclusive Growth – Phase 2 and to the Fast Retailing Co., Ltd. through the ILO/Fast Retailing Project on Unemployment Protection in Indonesia – Quality Assistance for Workers Affected by Labour Adjustments for their support in providing financial assistance to, respectively, the development of this report and the development of distance learning on ICT skills based on findings in this report. The rapid assessment was carried out in May–June 2020 and the report was finalized in October 2020 as part of the ILO/Japan-funded Project.

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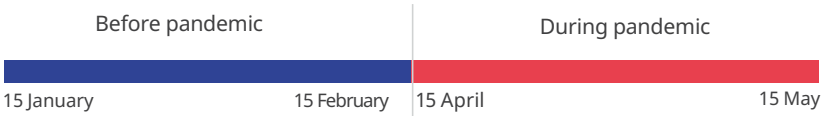
Source: christina-wocintechchat-unsplash

Rapid Assessment of information and communication technology skills demands in Indonesia 2020

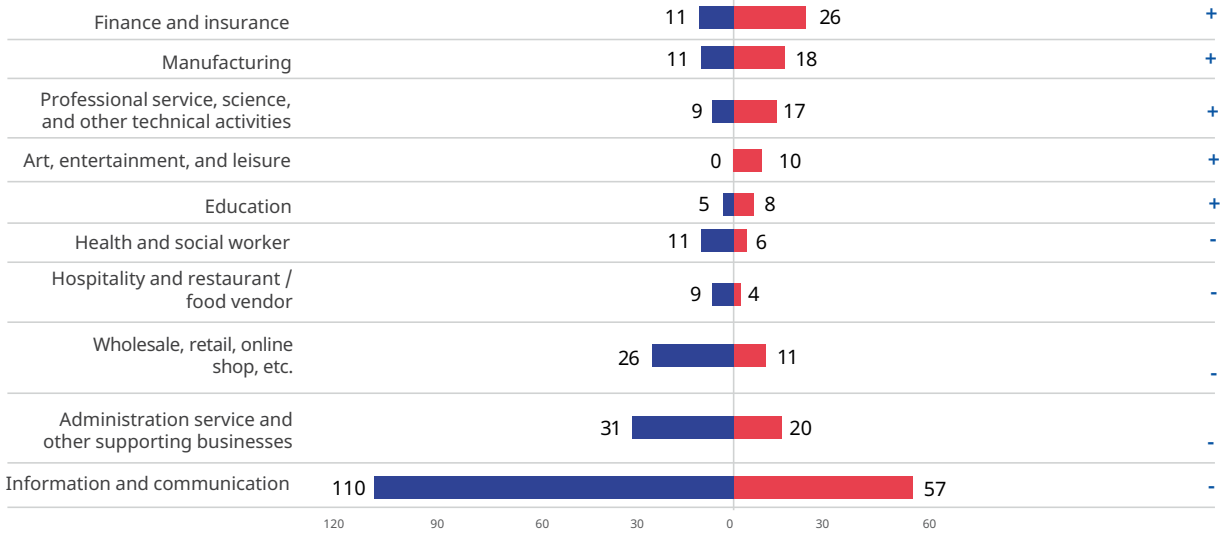
This rapid assessment of Information and Communication Technology (ICT) skill demands was conducted by analysing available ICT job vacancies and direct surveys of companies.

Data collection period

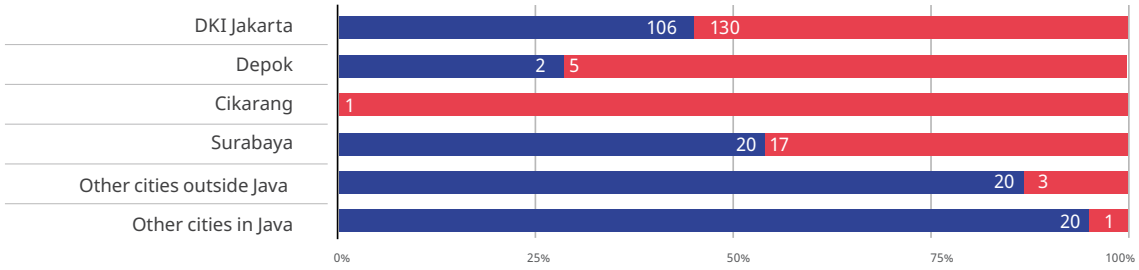


436 ICT job vacancies

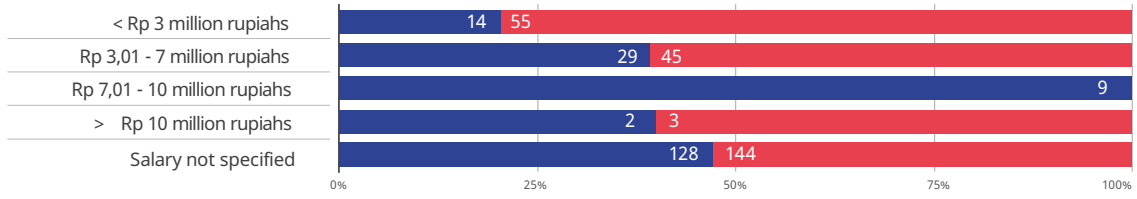
ICT job vacancies by industry



ICT job vacancies by location

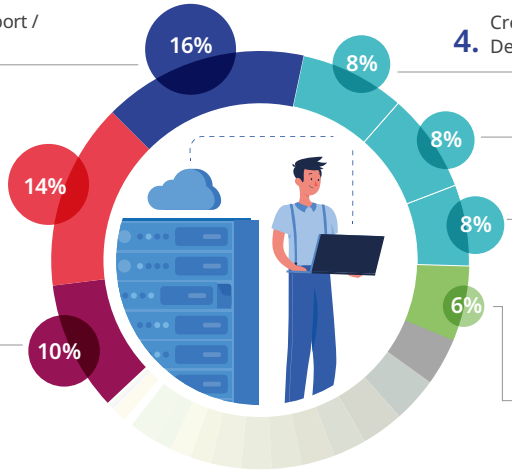


ICT job vacancies by salary

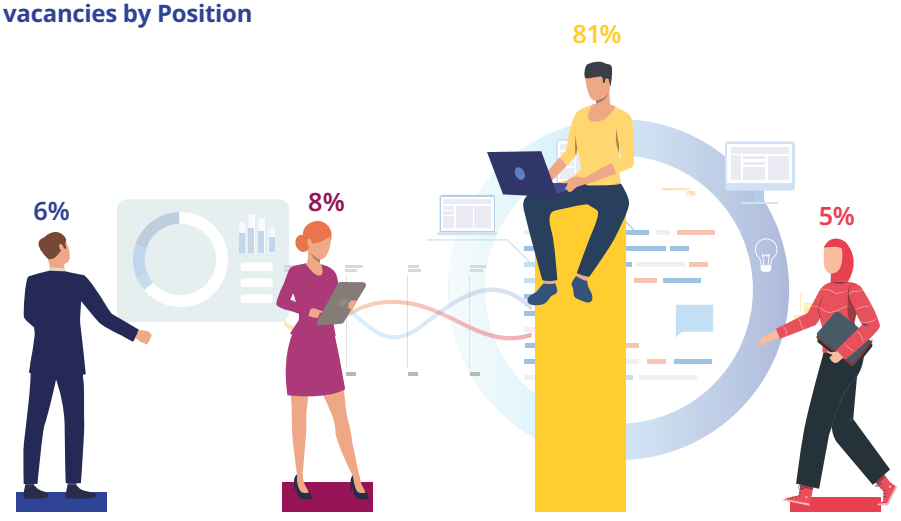


Top 5 ICT job vacancies by job title

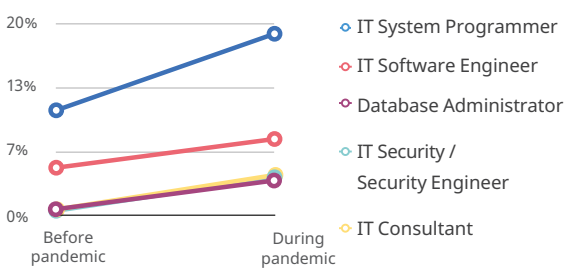
1. IT Support / Computer Support / Maintenance / Helpdesk
2. IT System Programmer / Developer / Admin / System Analyst (Java, iOS)
3. IT Web Designer & Developer (e.g. PHP, Magento, WordPress)
4. Creative Content / Content Creator / Creative Designer / Video Editor / Graphic Designer
4. Mobile App Developer / Android Developer / App Engineer
4. Social Media / Digital / Multimedia Admin / Officer / Marketing / SEO Specialist / Manager
5. IT Software Engineer / Quality Assurance / Quality Control / Tester / Developer (Odoo, Oracle, Angular)



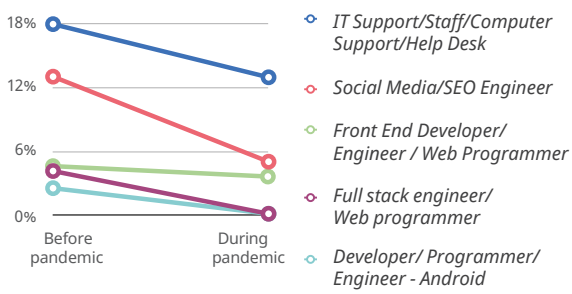
ICT job vacancies by Position



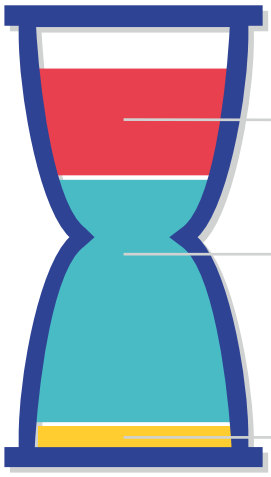
Five ICT jobs with greatest increase in demand during the pandemic



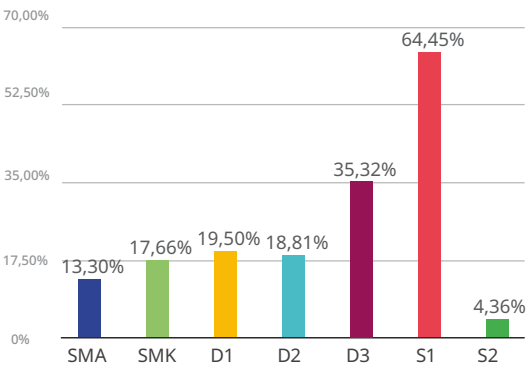
Five ICT jobs with largest decrease in demand during the pandemic



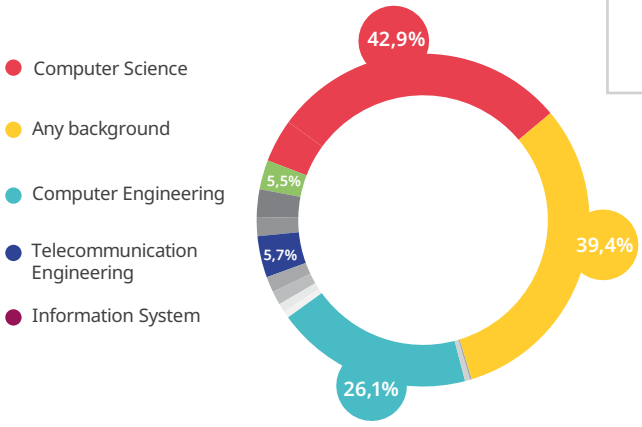
ICT job vacancies by experience level



Minimum education requirement for ICT jobs



Majors of Education Requirement for ICT Jobs



Position & location of jobs based on experience level

INTERMEDIATE (2–10 Years Experience)

Most commonly available jobs:

IT Software Engineer / Quality Assurance / Quality Control / Tester / Developer (Odoo, Oracle, Angular)	20%
IT System Programmer / Developer / Admin / System Analyst (Java, iOS)	15%
IT Web Designer & Developer (e.g. PHP, Magento, WordPress)	10.1%

Locations with highest job demand:

DKI Jakarta	72%
Surabaya	7%
Bandung	6%

BEGINNER (0–2 Years Experience)

Most commonly available jobs:

IT Support / Computer Support / Maintenance / Helpdesk	18%
IT System Programmer / Developer / Admin / System Analyst (Java, iOS)	13.6%
IT Web Designer & Developer (e.g. PHP, Magento, WordPress)	10.1%

Locations with highest job demand:

DKI Jakarta	48%
DI Yogyakarta	11%
Surabaya	9%

APPRENTICE

Most commonly available jobs:

Creative Content / Content Creator / Creative Designer / Video Editor / Graphic Designer	28%
IT Web Designer & Developer (e.g. PHP, Magento, WordPress)	13.8%
Social Media / Digital / Multimedia Admin / Officer / Marketing / Specialist / Manager	13.8%

Locations with highest job demand:

DKI Jakarta	66%
DI Yogyakarta	10%
Tangerang	7%

ICT technical skills demanded by industry

- 50% — Back-End Developer for Windows & Linux, (Java, PHP, Python), C++, RPC, Springboot, Angular, RES, API, AWS, Node Js
- 30.7% — Database RDBMS (SQL, MYSQL, Oracle, PostGre) incl. DML, DDL, Jquery
- 22% — Front-End Developer (HTML, CSS, Bootstrap Java script, Telerik, Kendo)
- 21.6% — InDesign, CorelDRAW, Photoshop, Illustrator
- 11.2% — Mobile Programming (Android, iOS)
- Others

Non-technical skills demanded by industry

- Teamwork — 33.72%
- Communication — 20.18%
- Eager to learn — 12.39%
- Strong analytical skill and logic — 11.93%
- Honesty / Integrity — 11.93%
- Others

Language skills demanded by industry

- English — 95%
- Japanese — 3%
- Mandarin — 2%

*Vacancies may require more than one skill. The total number of vacancies being examined is 436. The percentages are based on that number. Therefore the total percentagaes if added up is more than 100%.

Analysis of Information and Communication Skills Training in BBPLK BEKASI

ICT training programmes conducted by BBLK Bekasi versus ICT skills demanded by industry based on the Rapid Assessment

IT Software Solution for Business
(required in 53% of job vacancies)

Client Server Programming
(required in 50% of job vacancies)

Web Development
(required in 48% of job vacancies)

Network Professional
(required in 42% of job vacancies)

Cloud Computing
(required in 42% of job vacancies)

Mobile Programming
(required in 36% of job vacancies)

Graphic Design
(required in 32% of job vacancies)

Computer Technician
(required in 19% of job vacancies)

Database Programming
(required in 16% of job vacancies)

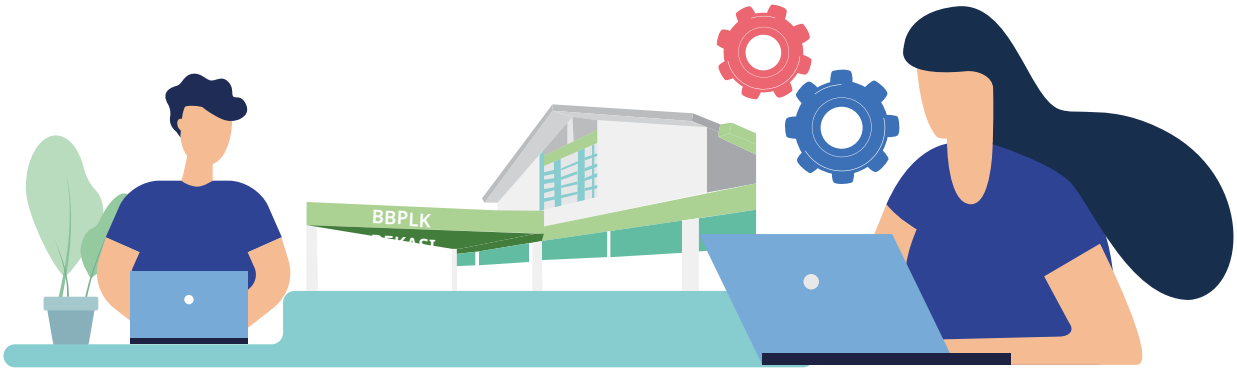
Animation
(required in 8% of job vacancies)

Movie Animation
(required in 8% of job vacancies)

Warehouse
(required in 0% of job vacancies)

Job vacancies	Training programmes teaching required skills
IT SUPPORT	
IT SYSTEM	
IT WEB DESIGNER	
SOCIAL MEDIA OFFICER	
CREATIVE CONTENT / GRAPHIC DESIGNER	

The table above shows that every job vacancy requires skills from **more than one training programme.**



3 ICT jobs that can be held by High School/ Vocational School graduates by optimizing ICT skills training at BBPLK Bekasi:

IT Support / Helpdesk

Graphic Designer / Content Creator

Web Designer

2 new training courses recommended to be conducted by BBPLK Bekasi in order to meet market demand

Java Developer

Job opportunities: Java Developer, Mobile Programmer (Android), Software Engineer, Back-End Developer

Front-End Developer

Job opportunities: JavaScript Developer, Full Stack Developer, Front-End Developer, Web Designer & Developer

Abbreviations and acronyms

APJII	Asosiasi Penyelenggara Jasa Internet Indonesia (Association of Indonesian Internet Providers)
ASEAN	Association for Southeast Asian Nations
BBPLK	Balai Besar Pengembangan Latihan Kerja (Centre for Vocational Training Development)
Covid-19	Coronavirus disease 2019
fintech	financial technology
ICT	information and communication technology
IT	information technology
LIPI	Lembaga Ilmu Pengetahuan Indonesia (Indonesian Institute of Sciences)
OJK	Otoritas Jasa Keuangan (Financial Services Authority)
SEO	search engine optimization
SMA	*sekolah menengah atas* (genior/general high school)
SMK	*sekolah menengah kejuruan* (vocational high school)
S1	*sarjana* (bachelor's level)
S2	*pasca sarjana* (postgraduate/master's level)
VTC	vocational training centre

1

INTRODUCTION

Introduction

Indonesia is the largest developing country in South-East Asia. With a population of more than 270 million (World Bank n.d.-a), increasing education levels and a youth population (15–24 years) that constitutes a fairly large portion (16 per cent) of the total workforce, Indonesia has the potential for substantial job creation. But challenges remain – the unemployment rate for Indonesian youth in 2018 was 16.4 per cent, higher than the global average youth unemployment rate of 15.2 per cent (World Bank n.d.-b).

In line with Indonesia's human resource development priorities, the ILO Jakarta Office is working with its constituents and social partners to address labour issues and skills development. Specifically, an ILO Skills Project funded by the Japanese Government and implemented in February 2019 aims to enhance cooperation between industry and vocational education and training institutions; to promote and pilot digital skills and distance learning; and to create synergies between skills development and other labour market policies.

Industry 4.0 poses the threat of job losses in labour-intensive industries such as the textile, garment and footwear industry. Many new skills are needed for future industries, such as those in the information and communication technology (ICT) sector. The ICT sector – including such diverse areas as financial technology (fintech), animation, e-commerce, blockchain and so on – will continue to grow in line with the development of industry 4.0. This is apparent from the significantly increasing number of internet users in Indonesia in the last decade, with growth from 20 million in 2007 to 171.2 million in 2018 (an 8.5-fold increase in roughly a decade) (APJII 2018). Indonesia has the largest digital economy value among countries in the Association of Southeast Asian Nations (ASEAN) region, at an estimated value of US$40 billion, and it is expected to grow to US$133 billion in 2025 (Liputan6.com 2020). Indonesia also has a large potential digital market with an active initial ecosystem, with 2,193 start-ups in 2019 (Databoks 2019), five of which have become "unicorns" (Clinten 2019).

With the rapid development of industry and technology, jobseekers need an understanding of the types of jobs available, how to find a job and the skills needed to get a job. There is a need for a mechanism to guide individuals who are about to enter the labour market and for workers who are at risk of losing their jobs in order to enable them to enter the growing ICT sector.

In line with the above, one of the objectives of the Japan-funded Skills Project is to improve the quality of ICT skills training at the Center for Vocational Training Development (Balai Besar Pengembangan Latihan Kerja – BBPLK), which can then be used as a reference for skills development organized by vocational training centres (VTCs) in Indonesia. The ICT skills training at BBPLK Bekasi will be adjusted and strengthened to suit the current needs of industry, which will further reduce the skills gap between skills providers and industry.

In 2018, the ILO Jakarta Office conducted a study on the labour demand in the ICT sector and predicted that employment in the ICT sector would increase in line with the digitalization

of various industries. In fact, in February 2020 Indonesia became the country with the largest digital economy sector in South-East Asia and Kompas has reported that 64 per cent of Indonesia's population are connected to the internet (Pertiwi 2020). However, since March 2020, Indonesia has become one of the many countries affected by the Covid-19 pandemic, which has forced several industries to halt their productive activities, resulting in the loss of several job opportunities.

The Indonesian Institute of Sciences (Lembaga Ilmu Pengetahuan Indonesia – LIPI), based on the findings of an online survey conducted with the Ministry of Manpower and the University of Indonesia in May 2020, predicts that unemployment in Indonesia will grow to 25 million people and the number of households beneath the poverty line will grow to 17.5 million by August 2020 due to the Covid-19 pandemic (LIPI 2020). However, the imposition of social restrictions to curb the pandemic does not mean that people's consumption stops. Although several industries, such as transportation and tourism, have been severely affected, other industries have seen increased demand. More importantly from the perspective of the ICT sector, many business transactions that were previously done offline are now starting to go online.

Given that the world of work and skills needs are rapidly changing and developing, in May 2020 the ILO Jakarta office organized another survey to identify skills needs and job opportunities in the ICT sector.

The vocational training institutions have a very important role as providers of skills for jobseekers and workers – skills that can later maintain productivity and business sustainability. The Indonesian Government is aiming to continue developing vocational training institutions in various regions and to support the existing vocational training programmes by 305 public VTCs, 249 BLKLNs (Overseas Training Centres for migrant workers), 8,688 job training institutions under the Ministry of Manpower and 19,000 under the coordination of the Ministry of Education and Culture (Malik, Jasmina, and Ahmad 2019). However, not all of these training institutions offer training relevant to the ICT sector.

BBPLK Bekasi is one of the centres that offers ICT skills education and it serves a reference for curriculum development at other VTCs. For this reason, this rapid assessment also explores the suitability of the ICT programme offered by BBPLK Bekasi with regard to the skills in demand in the ICT sector. It is hoped that by looking at both skills demand and supply, this rapid assessment can provide comprehensive input to stakeholders in order to maintain the availability of quality jobs and work in Indonesia.

2

THE ICT SECTOR AND ICT LABOUR MARKET IN INDONESIA

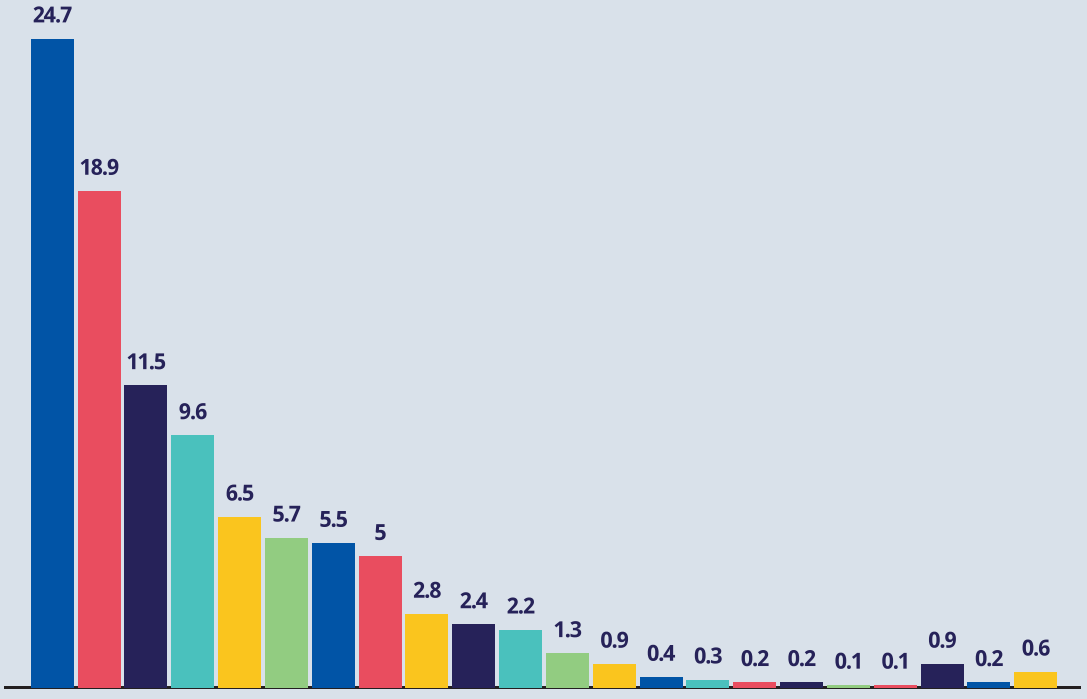
The ICT sector and ICT labour market in Indonesia

An archipelago country of 16,056 islands, 50 per cent of which are inhabited (BPS 2015; 2018), Indonesia is expected to become the fourth-largest economy in the world by 2050 (Hawksworth, Audino and Clarry 2017).

The Indonesian Internet Service Providers Association (Asosiasi Penyelenggara Jasa Internet Indonesia – APJII) reports that as of 2018, 65 per cent of Indonesia's population (171 million people) had internet access. Regionally, the largest numbers of internet users were found on Java island (56 per cent of all users, with most located in West Java); followed by Sumatera (22 per cent, most users in North Sumatera); Sulawesi, Papua and Maluku (11 per cent, most users in South Sulawesi); Kalimantan (7 per cent, most users in West Kalimantan) and Bali, Nusa Tenggara (5 per cent, most users in West Nusa Tenggara). Internet penetration in urban areas reached 74 per cent, while in rural areas it reached 62 per cent.

Of these internet users, 94 per cent used the internet every day and via mobile phones, and nearly 11.5 per cent used the internet to access job vacancies (see figure 1).

Figure 1. What is your main reason of using internet? (%)



Source: APJII 2018, 34.

Along with the increased penetration of technology and the growth of new industries, the development of the digital economy has begun to be felt in different sectors. In the financial sector, for example, the Financial Services Authority (Otoritas Jasa Keuangan – OJK) reported that in the period of January to April 2020 loan distribution summarized from 161 fintech companies across Indonesia increased 187 per cent compared to the same period in 2019, with accumulated loans valued at 106.06 trillion rupiahs (OJK 2020). In the trade sector, there are at least 50 companies providing digital marketplaces (e-commerce platforms) in Indonesia, which are visited by millions of visitors from Sabang to Merauke every month (iPrice Indonesia n.d.). In the tourism sector, the booking of tickets, accommodation and tourist activities is increasingly being done online.

It is not an exaggeration to estimate that by going digital, Indonesia can unleash the next level of economic growth to the tune of US$150 billion by 2025 by focusing on mobile internet, cloud technology, the internet of things, and big data and advanced analytics (Das et al. 2016). The internet of things, or products connected to the internet, has become a major development in the ICT industry in much the same way as mobile applications a few years ago.

Different ministries have issued programmes to support the growth of industries related to ICT support. For example, the Ministry of Tourism (2019) has made an invitation to build digital destinations. The Ministry of Industry (2019) has set five priority industries that will implement industrial technology 4.0, namely the food and beverage, chemical, textile, electronic and automotive industries. The Ministry of Communication and Information (2020) has set seven strategic sectors whose digitization processes will be supported: education, tourism, finance, health, transportation, agriculture and fisheries.

At the regional level, ASEAN has launched the Master Plan on ASEAN Connectivity 2025, which emphasizes the importance of digital development – including the joint development of infrastructure, human resources and technology – in order to reduce gaps between countries or between regions. The so-called "digital divide" is a major development challenge in Indonesia, and includes unequal infrastructure development and supporting regulations at the sub-national level; unequal public access to information; and unequal human resource capabilities in the ICT sector. With the opening of ASEAN single market providing economic opportunities and spurring mobility within the region, there are opportunities for job creation related to the widening market reach of Indonesian products/services, but there will also be challenges for Indonesia if there are no human resources available with the ability to respond to these opportunities.

Job opportunities in the ICT sector are not always characterized by permanent employment. It is instead common for workers in the technology sector to work as freelancers/contract workers. Many companies also hire service companies to manage ICT-related activities because this way the company can focus more on its main business activities. The current labour market environment is also dominated by online job search platforms. These platforms provide an opportunity for jobseekers to search for jobs outside their localities, or even abroad, and allow jobseekers to learn about job opportunities and job specifications more efficiently, because they are dynamic. For this reason, this rapid assessment of the ICT skills needs to take into account the aforementioned developments.

3

METHODOLOGY

Methodology

The rapid assessment of Indonesia's ICT skills needs was conducted through two sources, namely:

- Secondary data: through collecting data on ICT job vacancies available online.
- Primary data: through online surveys of companies in different industries.

Secondary data involved collecting data on ICT job vacancies in two periods: (i) 15 January to 15 February 2020, and (ii) 15 April to 15 May 2020. It is important to note that these two data collection periods fall before and after 2 March, when the Government acknowledged the first cases of Covid-19 in Indonesia. Primary data was collected in May 2020.

The rapid assessment involved an analysis of 436 ICT job vacancies advertised on various online media, as well as surveys of companies. Both secondary and primary data collection identified ICT job demand in terms of:

- job title
- level of work experience (apprenticeship, beginner and intermediate)
- position (staff or manager)
- work location
- industry
- technical and non-technical (soft) skills required
- language skills required
- educational attainment required and
- starting salary/wage offered.

Of the aforementioned 436 job vacancies analysed, 247 (57 per cent) were advertised during the January–February collection period (pre-Covid-19), and 189 (43 per cent) were advertised during the April–May collection period (during-Covid-19). By capturing data from both periods, it is hoped that this rapid assessment will provide a balanced picture of skills needs before and after Covid-19 began to impact the ICT sector in Indonesia.

A number of media sources were used to collect ICT job vacancy data (figure 2). During the January–February data collection period, the two most prominent sources were Loker.id (39 per cent) and Careerjet (19 per cent). During the April–May collection period, the most prominent sources of job vacancies were Jobstreet (28 per cent), JobsDB (20 per cent) and Karir.com (2 per cent). The survey of companies summarizes 4 per cent of available ICT job vacancies.

The rapid assessment also examined job vacancies at three levels of work experience: apprenticeship (fresh graduate/without work experience); beginner (0–2 years of work experience); and intermediate (2–10 years of work experience). Job vacancies for experts, seniors and executives were not included in the scope of the study. Seventy-four per cent of the available vacancies were for entry level roles, followed by intermediate roles at 19 per cent and apprenticeships at 7 per cent (see figure 3).

Figure 2. Media sources used in the rapid assessment, by percentage of all ICT job vacancies analysed(%)

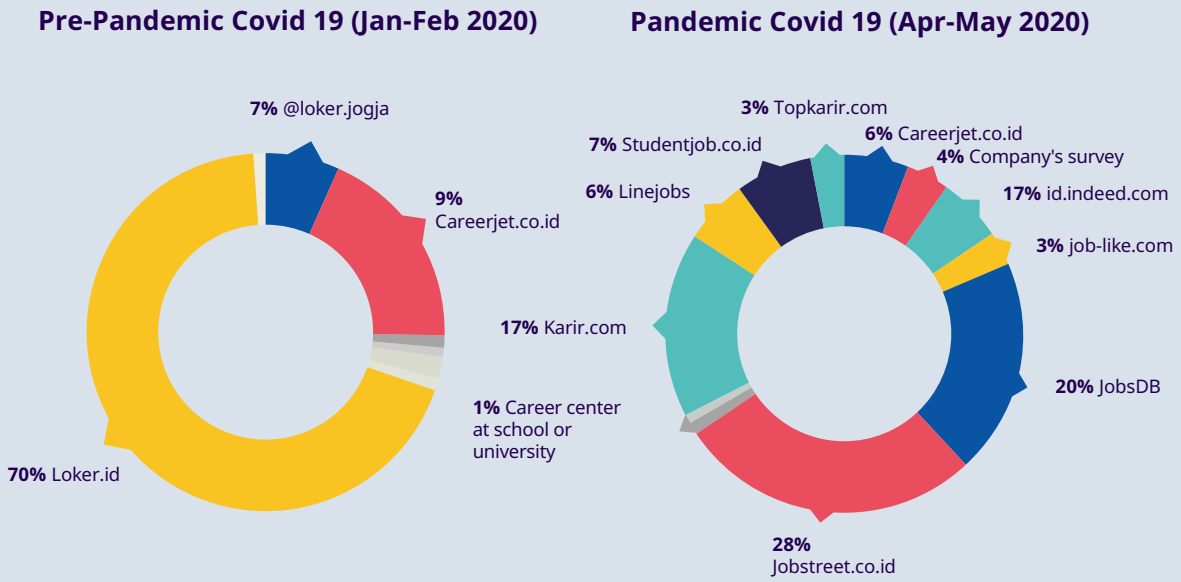
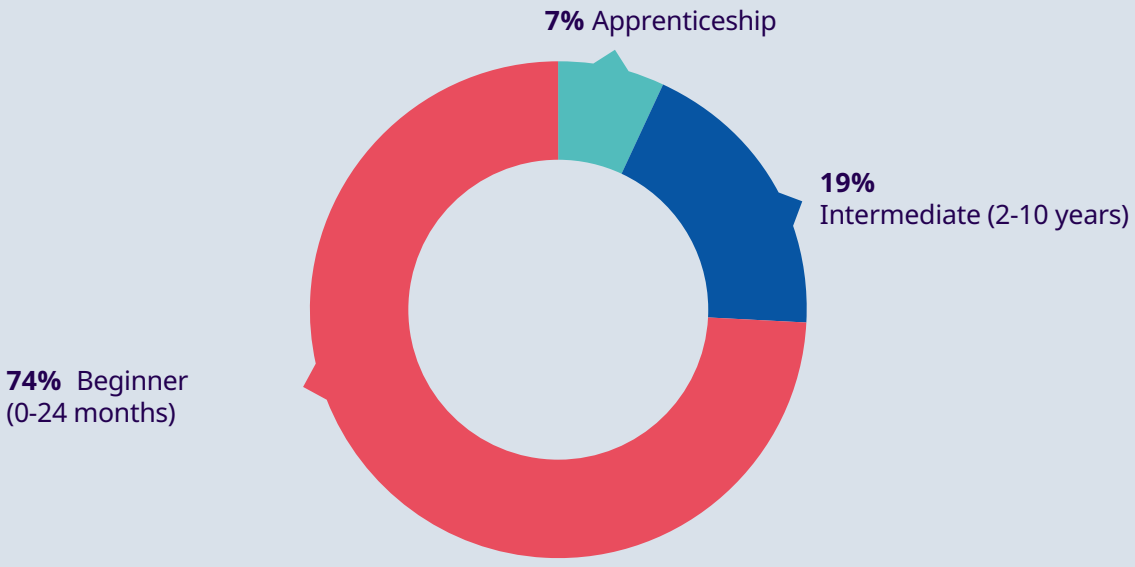


Figure 3. ICT job vacancies by level of work experience



Most companies in Indonesia, especially those in need of workers with ICT skills, are located on Java island. This study, therefore, focuses on big industrial cities in Java – namely Jakarta, Bogor, Depok, Tangerang, Bekasi, Cikarang, Karawang, Bandung, Yogyakarta and Surabaya – but still remains open to an understanding of the location of job vacancies outside the cities mentioned above.

Data validation has been conducted by ensuring there has been no duplication of job vacancies, as job advertisements may be posted in more than one place.

4

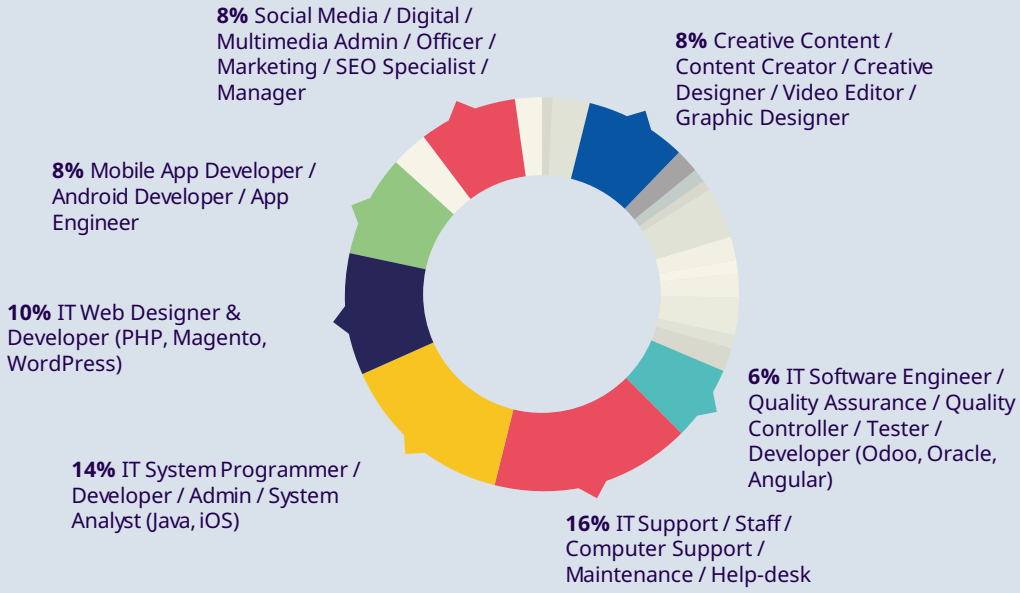
FINDINGS OF THE RAPID ASSESSMENT

Findings of the rapid assessment

4.1 Job vacancies by job title

This rapid assessment identifies job vacancies by position. Figure 4 di bawah ini shows the positions demanded in ICT job vacancies in the various media mentioned.

Figure 4. Job vacancies by job title (% of all vacancies)



Note: The larger numbers within the figure represent the ranking from most to least common.

As seen in figure 4 above, the most in-demand ICT roles based on job vacancy advertisements are:

- IT support / computer support / maintenance / helpdesk – 16 per cent of job vacancies advertised;
- IT system programmer / developer / system analyst – 14 per cent;
- IT web designer and developer – 10 per cent;
- Social media / digital / multimedia / marketing / SEO specialist / manager – 8 per cent;

[16] Also worth exploring is an earlier report by the same author: Colin C. Williams, "The Informal Economy and Poverty: Evidence and Policy Review" (2014, Joseph Rowntree Foundation).

- Creative content / content creators / creative designers /video editors / graphic designers – 8 per cent
- Mobile app developers and engineers – 8 per cent; and
- IT software engineer / quality assurance / quality control / tester / developer – 6 per cent.

Details concerning the number of job vacancies by job title can be seen in table 1 on the next page.

Table 1

ICT job vacancies by job title, all vacancies (n=436)

Job title(s)	No. of vacancies	%
IT Support / Computer Support / Maintenance / Help Desk	68	15.6
IT System Programmer / Developer / Admin / System Analyst (Java, iOS)	63	14.4
IT Web Designer & Developer (e.g., PHP, Magento, Wordpress)	44	10.1
Social Media / Digital / Multimedia Admin / Officer / Marketing / SEO Specialist / Manager	36	8.3
Creative Content / Content Creator / Creative Designer / Video Editor / Graphic Designer	35	8.0
Mobile App Developer / Android Developer / App Engineer	33	7.6
IT Software Engineer / Quality Assurance / Quality Control / Tester / Developer (Odoo, Oracle, Angular)	27	6.2
Front-End Developer / Engineer / Web Programmer	16	3.7
IT Network / Network Engineer / Network Administrator	15	3.4
Network Programmer / Developer (e.g., .NET, ERP, ASP, C#)	15	3.4
Back-End Developer / Programmer / Engineer	12	2.8
Full Stack Engineer / Web Programmer / Developer	10	2.3
UI/UX Developer / Designer	10	2.3
Database / Storage / Server Engineer / Administrator	10	2.3
IT Security / Security Engineering / Security Programmer / Cyber Security	9	2.1
IT Consultant (SAP, Bootcamp)	7	1.6
Developer / Programmer / Engineer – Android	6	1.4
Developer Unity / C++ / Python / Android	5	1.1
Account / Sales Executive	4	0.9
IT Project Manager	4	0.9
IT / Computer Teacher	3	0.7
Developer / Programmer / Engineer – Delphi	2	0.5
Division Manager – VMware	1	0.2
Finance Engineer	1	0.2
Total	**436**	**100.0**

In relation to the Covid-19 pandemic, table 2 below summarizes the number of job vacancies by position in the periods before and during the Covid-19 pandemic, and the changes seen between the two data collection periods.

Table 2

ICT job vacancies by job title before Covid-19 (n=247) and during Covid-19 (n=189)

Job title(s)	Before Covid-19[1]		During Covid-19[2]		Change (+/–)[3]
	No. of vacancies	%	No. of vacancies	%	
IT Support / Computer Support / Maintenance / Help Desk	44	17.8%	24	12.7%	–
Social Media / Digital / Multimedia Admin / Officer / Marketing / SEO Specialist / Manager	29	11.7%	7	3.7%	–
IT System Programmer / Developer / Admin / System Analyst (Java, iOS)	27	10.9%	36	19.0%	+
IT Web Designer & Developer (e.g., PHP, Magento, Wordpress)	26	10.5%	18	9.5%	–
Mobile App Developer / Android Developer / App Engineer	20	8.1%	13	6.9%	–
Creative Content / Content Creator / Creative Designer / Video Editor / Graphic Designer	19	7.7%	16	8.5%	–
IT Software Engineer / Quality Assurance / Quality Control / Tester / Developer (Odoo, Oracle, Angular)	12	4.9%	15	7.9%	+
Front-End Developer / Engineer / Web Programmer	11	4.5%	5	2.6%	–
IT Network / Network Engineer / Network Administrator	10	4.0%	5	2.6%	–
Full Stack Engineer / Web Programmer / Developer	10	4.0%	nil	0.0%	–
Network Programmer / Developer (e.g., .NET, ERP, ASP, C#)	8	3.2%	7	3.7%	even
Back-End Developer / Programmer / Engineer	7	2.8%	5	2.6%	even
UI/UX Developer / Designer	6	2.4%	4	2.1%	even
Developer / Programmer / Engineer – Android	6	2.4%	nil	0.0%	–
Developer Unity / C++ / Python / Android	3	1.2%	2	1.1%	even
Database / Storage / Server Engineer / Administrator	2	0.8%	8	4.2%	+

Job title(s)	Before Covid-19[1]		During Covid-19[2]		Change (+/–)[3]
	No. of vacancies	%	No. of vacancies	%	
Developer / Programmer / Engineer – Delphi	2	0.8%	nil	0.0%	even
IT Security / Security Engineering / Security Programmer / Cyber Security	1	0.4%	8	4.2%	+
IT Consultant (SAP, Bootcamp)	1	0.4%	6	3.2%	+
Account / Sales Executive	1	0.4%	3	1.6%	even
Division Manager – Vmware	1	0.4%	nil	0.0%	even
Finance Engineer	1	0.4%	nil	0.0%	even
IT Project Manager	nil	0.0%	4	2.1%	+
IT / Computer Teacher	nil	0.0%	3	1.6%	+
Total	**247**	**100%**	**189**	**100%**	**n.a.**

Note: n.a. = not applicable.

[1] "Before Covid-19" refers to the Jan.–Feb. 2020 secondary data collection period.
[2] "During Covid-19" refers to the Apr.–May 2020 data collection period.
[3] A change of two or less in the number of vacancies is considered as "even".

In general, almost all ICT roles were still available despite the Covid-19 pandemic, and there were eight jobs that experienced an increase in demand, namely:

- IT system programmer (from 10.9 per cent of vacancies to 19 per cent);
- IT software engineer (from 4.9 per cent to 7.9 per cent);
- Database administrator (from 0.8 per cent to 4.2 per cent);
- IT security / security engineer (from 0.4 per cent to 4.2 per cent);
- IT consultant (from 0.4 per cent to 3.2 per cent);
- IT project manager (from no vacancies to 2.1 per cent);
- Account executive (from 0.4 per cent to 1.6 per cent).
- IT computer teacher (from no vacancies to 1.6 per cent)

These roles may be more in demand in the current climate because the Covid-19 pandemic has forced companies to switch to online business activities, both for transactions and for communication with customers and suppliers. To achieve this, there are increasing needs for system programmers, software engineers, database administrators and project managers.

Furthermore, there are 9 jobs that have seen decreased demand from before to during the Covid-19 pandemic period. The five positions showcasing the largest decreases are:

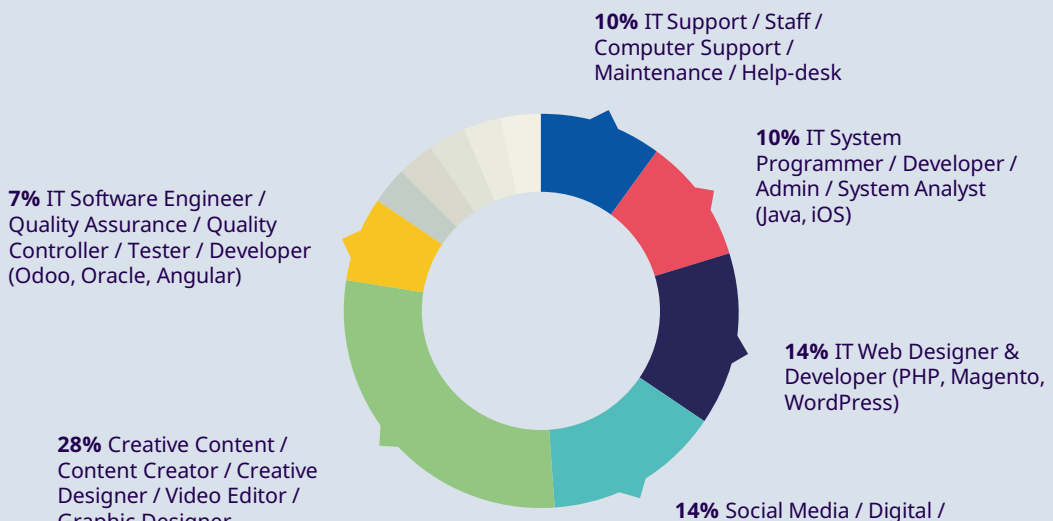
- IT support / computer support / help desk (from 18 per cent to 13 per cent);
- Social media / SEO (from 12 per cent to 4 per cent);
- Front-end developer/engineer/web programmer (from 4.5 per cent to 2.6 per cent).
- Full stack engineer / web programmer (from 4 per cent to no vacancies);
- Developer / programmer / engineer – Android (from 2.4 per cent to no vacancies); and

Although some jobs have seen substantial decreases in demand, certain roles that were in high demand prior to the pandemic – such as web designer, mobile app developer and creative content designer – have remained relatively stable.

4.2 Job vacancies for each level of work experience

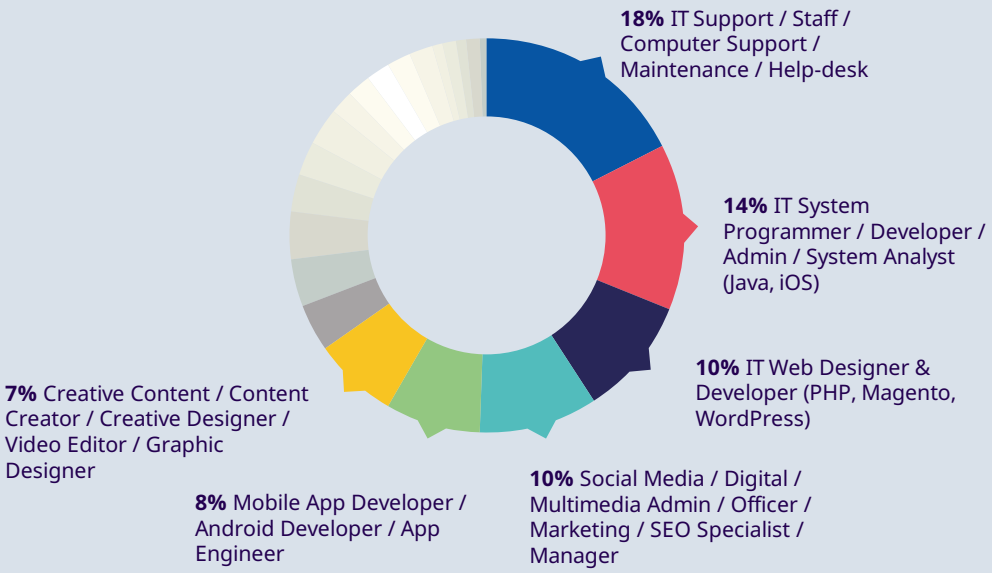
Figures 5–7 below illustrate the job vacancies available for each of the three levels of work experience considered in the rapid assessment: apprenticeship (fresh graduate/without work experience); beginner (0–2 years of work experience); and intermediate (between 2–10 years of work experience).

Figure 5. Apprenticeship opportunities in the ICT sector



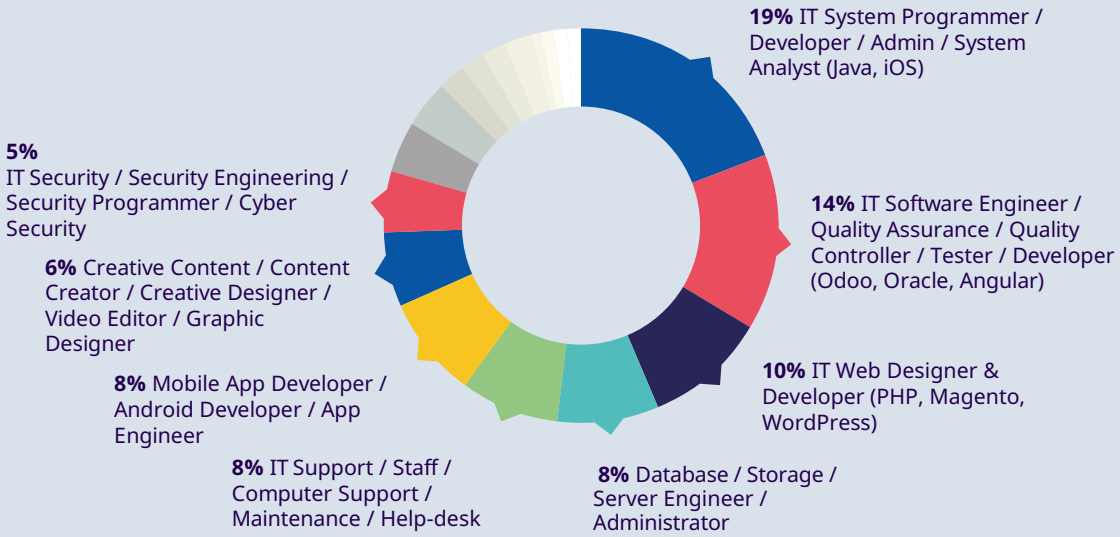
About 7 per cent of the companies in this rapid assessment offered apprenticeship opportunities in the ICT sector. Apprenticeship opportunities are most commonly offered for jobs as creative content/content creator/creative designer/video editor/graphic designer (28 per cent). Apprenticeship opportunities are also offered for social media/multimedia/marketing positions (14 per cent); IT web designer/developer (14 per cent); IT system programmer/developer (10 per cent); IT support/computer support/helpdesk (10 per cent); and IT software engineer/quality assurance/quality control (7 per cent).

Figure 6. Job vacancies at the beginner level in the ICT sector



It is apparent that the variety of ICT jobs at the beginner level (0–2 years of work experience) is greater than what is available for apprenticeships. The main vacancies were found to be for IT support (18 per cent); IT system programmer/developer (14 per cent); IT web designer/developer (10 per cent); social media officer/digital officer/multimedia/marketing (10 per cent); and mobile app developer (8 per cent).

Figure 7. Job vacancies for intermediate level workers in the ICT sector



It is apparent that the more experience one has working in the ICT sector, the greater the variety of jobs that can be found. The most common job vacancies at the intermediate level (2–10 years of experience) are IT system programmer/developer/system analyst (19 per cent); followed by IT software engineer/quality assurance/quality control (14 per cent); IT web designer and developer (10 per cent); mobile app developer (8 per cent); database/storage/server engineer or administrator (8 per cent); and IT support/computer support/helpdesk (8 per cent).

Table 3 compares the various job vacancies available for the three levels of work experience addressed in the rapid assessment. It readily is apparent that jobs offered at the apprenticeship level are also almost always open to intermediate-level workers. However, there are jobs that are not open for apprenticeships, such as mobile app developer, IT security engineer, front-end engineer, network engineer, back-end developer, project manager, and so on. This is understandable, as these jobs require relatively long development time, long hours and/or intensive work, and may be related to confidential company data, making it impossible for apprentices to perform them.

Table 3

Availability of job vacancies for specific roles in the ICT sector, by experience level

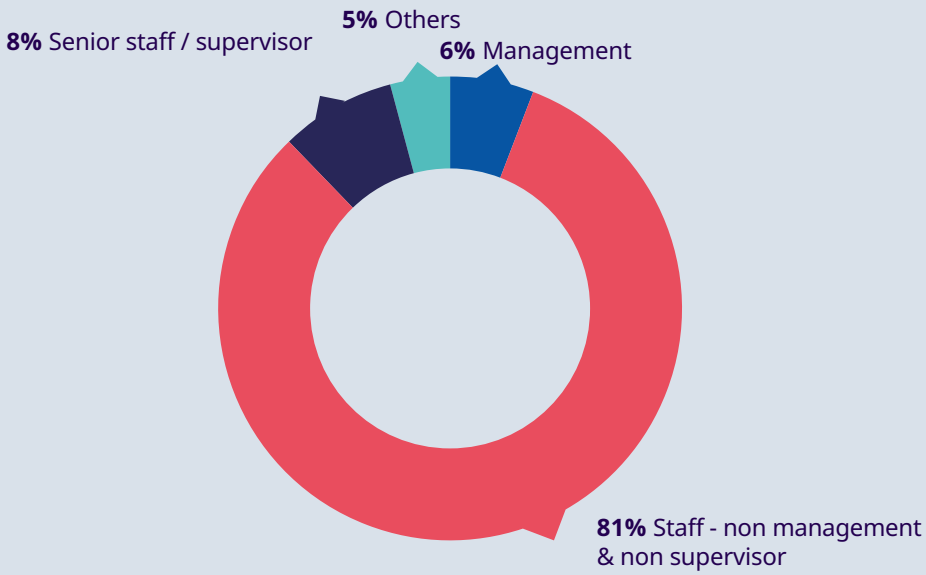
Job title(s)	Vacancies available		
	Apprentice	Beginner (0–2 years)	Intermediate (2–10 years)
Creative Content / Content Creator / Creative Designer / Video Editor / Graphic Designer	√	√	√
Database / Storage / Server Engineer / Administrator	√	√	√
IT Consultant (SAP, Bootcamp)	√	√	√
IT Software Engineer / Quality Assurance / Quality Control / Tester / Developer (Odoo, Oracle, Angular)	√	√	√
IT Support / Computer Support / Maintenance / Help Desk	√	√	√
IT System Programmer / Developer / Admin / System Analyst (Java, iOS)	√	√	√
IT Web Designer & Developer (e.g., PHP, Magento, Wordpress)	√	√	√
Network Programmer / Developer (e.g., .NET, ERP, ASP, C#)	√	√	√
Social Media / Digital / Multimedia Admin / Officer / Marketing / SEO Specialist / Manager	√	√	√
UI/UX Developer / Designer	√	√	√
IT / Computer Teacher	√	–	√
Back-End Developer / Programmer / Engineer	–	√	√
Front-End Developer / Engineer / Web Programmer	–	√	√
IT Network / Network Engineer / Network Administrator	–	√	√
IT Project Manager	–	√	√
IT Security / Security Engineering / Security Programmer / Cyber Security	–	√	√
Mobile App Developer / Android Developer / App Engineer	–	√	√
Account / Sales Executive	–	√	–
Developer / Programmer / Engineer – Android	–	√	–
Developer / Programmer / Engineer – Delphi	–	√	–
Developer Unity / C++ / Python / Android	–	√	–
Finance Engineer	–	√	–
Full Stack Engineer / Web Programmer / Developer	–	√	–
Division Manager – Vmware	–	–	√

Note: √ = vacancy available; – = no vacancies available.

4.3 Job vacancies by position level

Based on the position, most of the advertised job vacancies were for staff positions that fall below the management/supervisor level (81 per cent), followed by senior staff positions (8 per cent) and management positions (6 per cent) (figure 8).

Figure 8. Job vacancies by position level in the ICT Sector



Notes: "Staff" refers to advertised vacancies for permanent, full-time positions below the senior staff/ supervisor and manager levels. "Others" refers to vacancies for apprenticeships, contract roles and part-time roles.

Table 4 gives more details on the breakdown of job vacancies for each position level, as it delineates the distribution of vacancies across the occupations/job titles identified by the assessment.

Table 4

Job vacancies by job title and position level in the ICT sector

Job title(s)	Staff[1]	Senior Staff/ Supervisor/	Management	Other[2]	All levels
IT Support / Computer Support / Maintenance / Help Desk	59	5	4	–	68

Job title(s)	Staff[1]	Senior Staff/ Supervisor/	Management	Other[2]	All levels
IT System Programmer / Developer / Admin / System Analyst (Java, iOS)	50	8	3	2	63
IT Web Designer & Developer (e.g., PHP, Magento, Wordpress)	37	5	–	2	44
Mobile App Developer / Android Developer / App Engineer	30	3	–	–	33
Social Media / Digital / Multimedia Admin / Officer / Marketing / SEO Specialist / Manager	28	3	2	3	36
Creative Content / Content Creator / Creative Designer / Video Editor / Graphic Designer	25	–	2	8	35
IT Software Engineer / Quality Assurance / Quality Control / Tester / Developer (Odoo, Oracle, Angular)	18	3	4	2	27
Front-End Developer / Engineer / Web Programmer	15	–	1	–	16
IT Network / Network Engineer / Network Administrator	15	–	–	–	15
Network Programmer / Developer (e.g., .NET, ERP, ASP, C#)	13	2	–	–	15
Back-End Developer / Programmer / Engineer	11	–	1	–	12
Full Stack Engineer / Web Programmer / Developer	9	1	–	–	10
UI/UX Developer / Designer	9	1	–	–	10
IT Security / Security Engineering / Security Programmer / Cyber Security	6	–	2	1	9
IT Consultant (SAP, Bootcamp)	6	–	–	1	7
Developer / Programmer / Engineer – Android	6	–	–	–	6

Job title(s)	Staff[1]	Senior Staff/ Supervisor/	Management	Other[2]	All levels
Database / Storage / Server Engineer / Administrator	5	4	1	–	10
Developer Unity / C++ / Python / Android	4	1	–	–	5
Account / Sales Executive	4	–	–	–	4
IT / Computer Teacher	2	–	–	1	3
Developer / Programmer / Engineer – Delphi	2	–	–	–	2
IT Project Manager	1	–	3	–	4
Finance Engineer	1	–	–	–	1
Division Manager – Vmware	–	–	1	–	1
Total	**356**	**36**	**24**	**20**	**436**

– = nil.

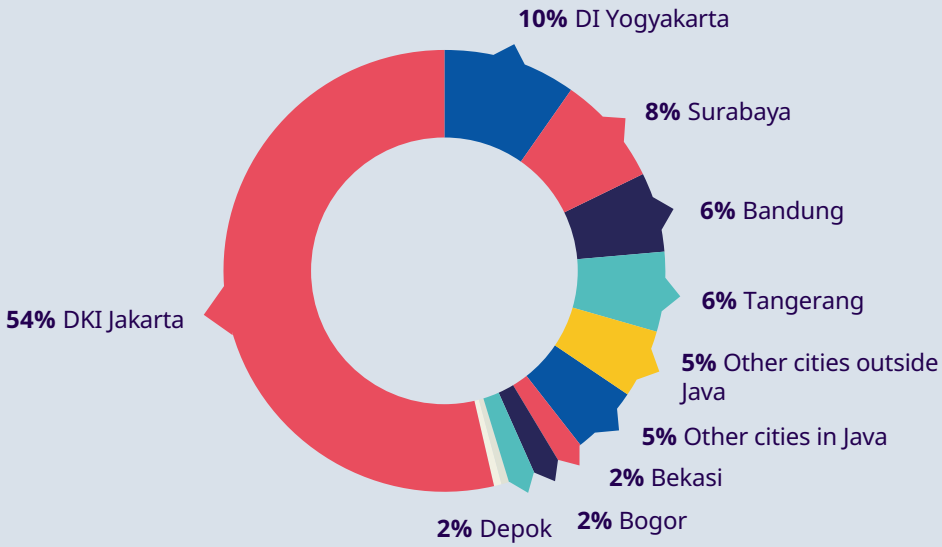
[1] "Staff" refers to advertised vacancies for permanent, full-time positions below the senior staff/supervisor and manager levels.
[2] "Other" refers advertised vacancies for apprenticeships, contract roles and part-time roles.

As seen above, several occupations/jobs are available across various position levels, from staff to supervisors to management. This can be seen with regard to vacancies for IT support, IT system programmer, social media, IT software engineer and database storage roles. Furthermore, this rapid assessment finds that some vacancies are for positions that do not fit in the full-time, permanent roles held by staff, supervisors or managers. Vacancies in this "Other" category include positions for apprentices, contract workers and part-time workers. These positions are for creative content/graphic designer, roles, which may be held by individuals working on a project basis or outside normal working hours.

4.4 Location of job vacancies

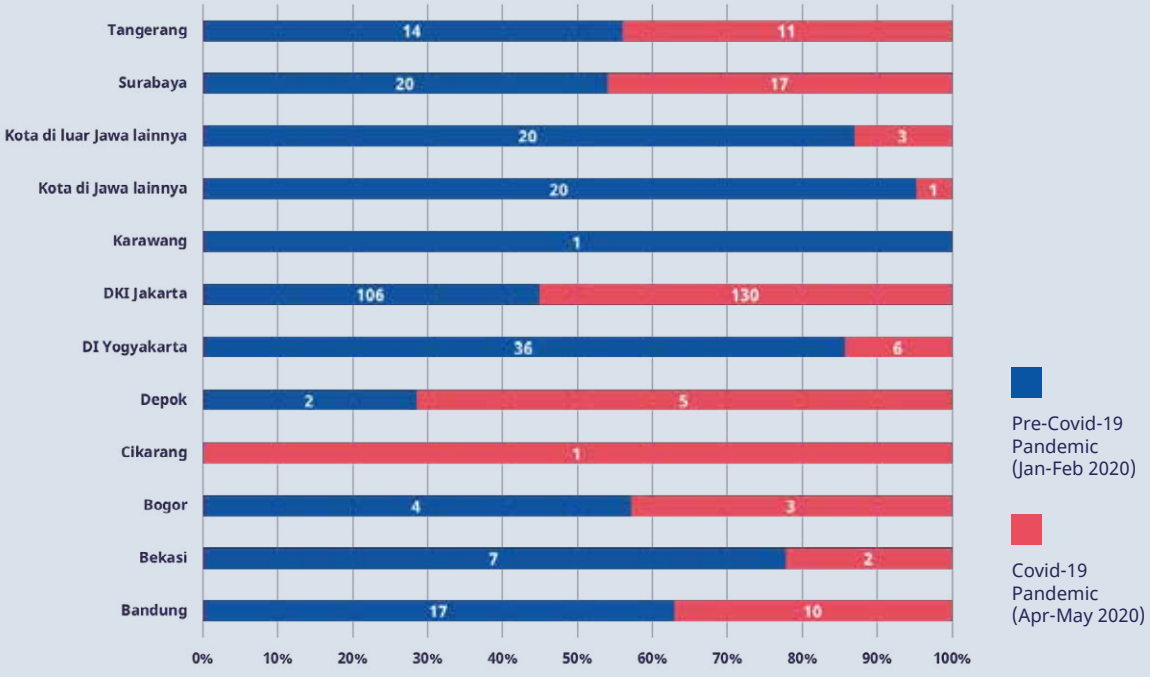
Jakarta is the city that provides the most job vacancies in the ICT sector (54 per cent); followed by Yogyakarta, Surabaya, Bandung and Tangerang. It was also found that job vacancies outside of long-established industrial areas have begun to appear, both in other cities on the Java island (5 per cent of vacancies) and outside Java (5 per cent of vacancies). Figure 9 provides a more detailed breakdown.

Figure 9. Locations of job vacancies in the ICT sector



A comparison of the locations of ICT job vacancies before and during the Covid-19 pandemic can be seen in figure 10 below.

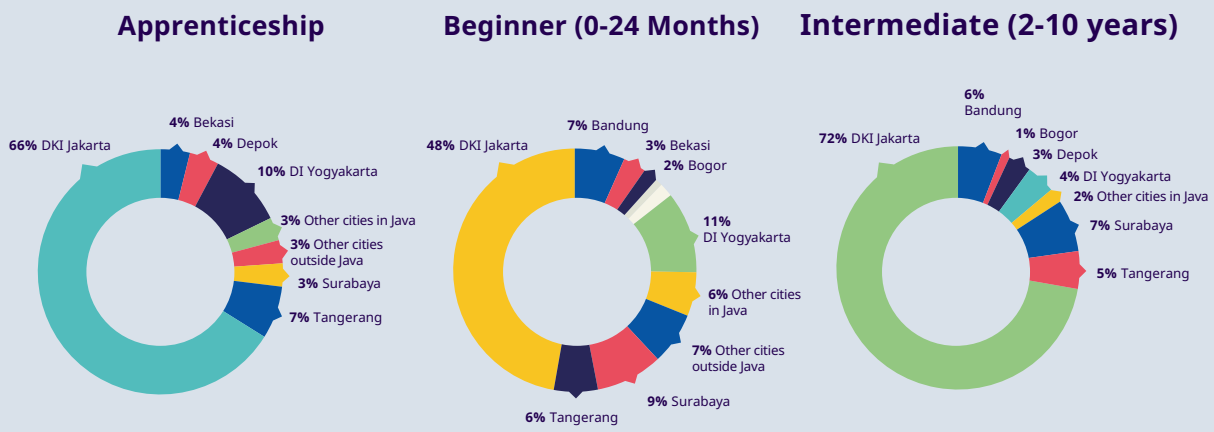
Figure 10. Location of job vacancies in the ICT sector, before and during the Covid-19 pandemic



It is apparent from the figure above that in big cities such as Tangerang, Surabaya, Jakarta and Bogor the number of job vacancies before and during the Covid-19 pandemic remained relatively stable. However, in other cities on Java island and in cities outside Java the number of vacancies fell after the pandemic hit.

Each city offers a different number of job vacancies based on the jobseekers' levels of experience required. Figure 11 below shows a comparison of job vacancies for each level of experience in different cities.

Figure 11. Locations of job vacancies in the ICT sector by amount of work experience level

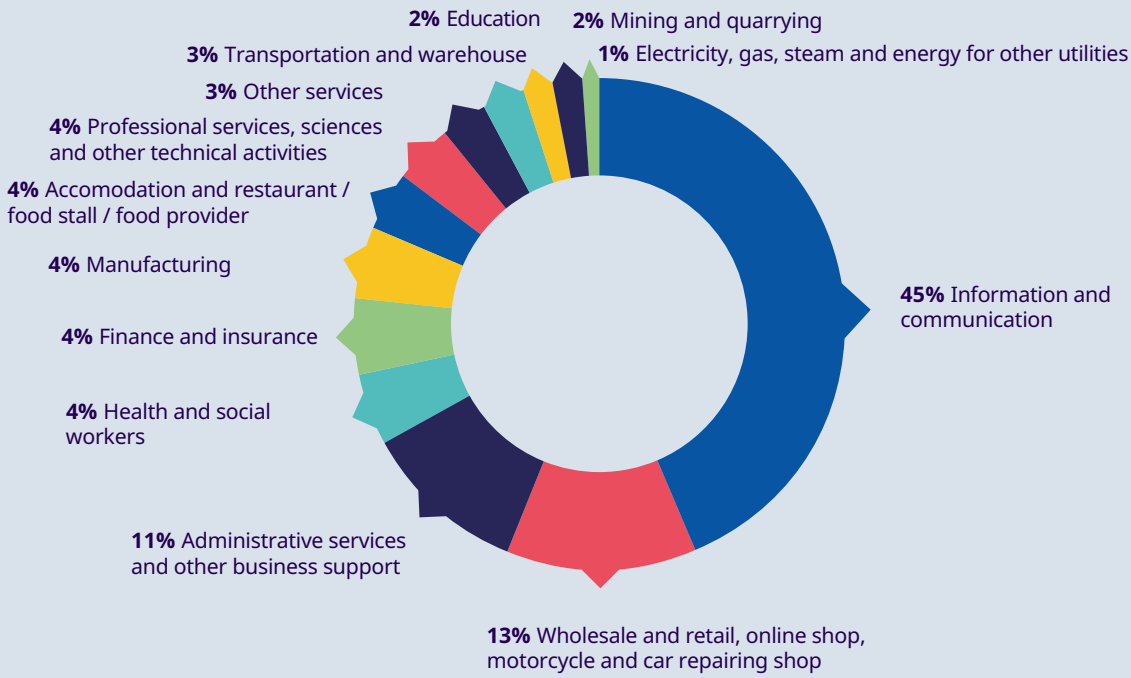


It is apparent that Jakarta is the city that offers the most job opportunities in the ICT sector at all levels of experience. Tangerang also offers job opportunities for various levels of experience, although the number of vacancies is much less than Jakarta. Yogyakarta offers a significant number of job opportunities for apprentices and beginner workers, while Bandung and Surabaya are more likely to offer job opportunities for beginner and intermediate workers.

4.5 Industries offering ICT job vacancies

Most ICT job vacancies are provided in the information and communication industry (45 per cent), followed by trade (13 per cent) and administrative services and other business support (11 per cent). Health and social work; finance and insurance; manufacturing; accommodation and food service; and other professional services / science / technical activities each offered 4 per cent of job vacancies. Other industries offer under 4 per cent of job vacancies.

Figure 12. Industries offering ICT job vacancies



This rapid assessment also looked at the impact of the Covid-19 pandemic on job vacancies in each industry, as seen in figure 13 and table 5. In general, job vacancies were more available before the Covid-19 pandemic. However, several industries have shown an increase in job vacancies during the Covid-19 pandemic. The industry with the highest proportional increase in job vacancies is financial services and insurance, with an increase of ten percentage points (from 4 per cent of all vacancies to 14 per cent). A proportional increase in job vacancies also occured in: the manufacturing industry (six percentage points), professional services/science/other technical activities (five percentage points), arts (five percentage points) and education (two percentage points). No job vacancies were found in the arts/entertainment/recreation industry before the pandemic; however, during the pandemic period ICT vacancies in this industry grew to contribute 5 per cent of all vacancies. This growth may resulted from people being encouraged to stay at home, and therefore entertainment/recreation needs had to be met remotely through ICT channels.

Figure 13. Distribution of ICT job vacancies by industry, before and during the Covid 19 pandemic

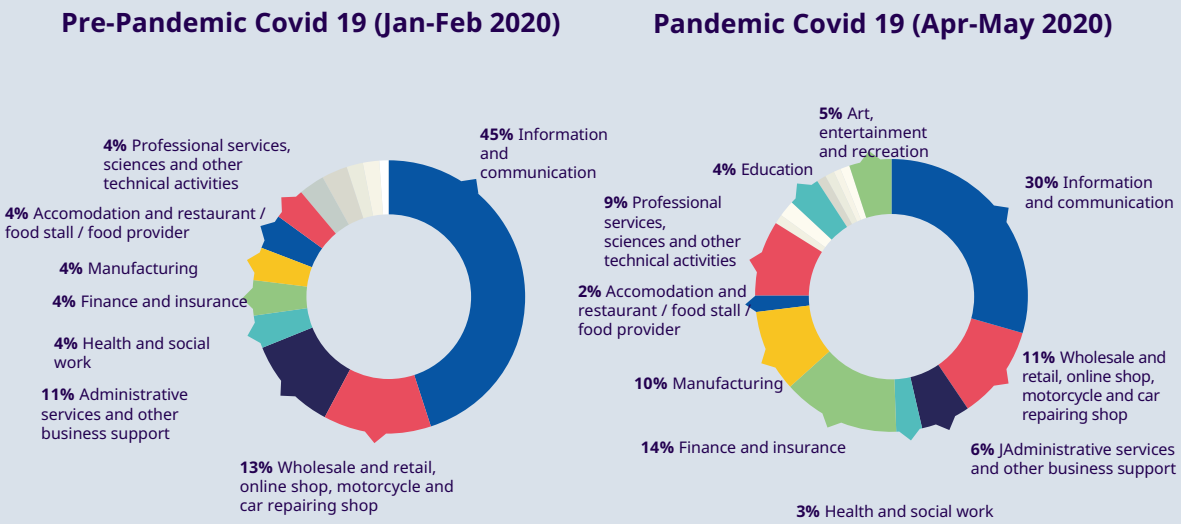


Table 5

ICT job vacancies by industry, before Covid-19 (n=247) and during the Covid-19 (n=189)

Industry	Before Covid-19[1]		During Covid-19[2]		Change (+/–)[3]
	No. of vacancies	%	No. of vacancies	%	
Information and communication	110	44..5%	57	30.2%	–
Wholesale and retail, online shop, motorcycle and car repairing shop	31	12.6%	20	10.6%	–
Administrative services and other business support	26	10.5%	11	5.8%	–
Health and social work	11	4.5%	6	3.2%	–
Finance and insurance	11	4.5%	26	13.8%	+
Manufacturing	11	4.5%	18	9.5%	+
Accomodation and restaurant / food stall / food provider	9	3.6%	4	2.1%	–
Professional services, sciences and other technical activities	9	3.6%	17	9.0%	+

Industry	Before Covid-19[1]		During Covid-19[2]		Change (+/–)[3]
	No. of vacancies	%	No. of vacancies	%	
Other services	8	3.2%	2	1.1%	–
Transportation and warehousing	7	2.8%	4	2.1%	–
Education	5	2.0%	8	4.2%	+
Mining and quarrying	4	1.6%	1	0.5%	–
Electricity, gas, steam and energy for other utilities	2	0.8%	1	0.5%	even
Activities across organizations and agencies	1	0.4%	1	0.5%	even
Building construction, engineering and other construction services	1	0.4%	1	0.5%	even
Agriculture, fishery and forestry	1	0.4%	2	1.1%	even
Art, entertainment and recreation	nil	0.0%	10	5.3%	+
Total	**247**	**100%**	**189**	**100%**	**n.a**

Note: n.a. = not applicable.

[1] "Before Covid-19" refers to the Jan.–Feb. 2020 secondary data collection period.
[2] "During Covid-19" refers to the Apr.–May 2020 data collection period.
[3] A change of two or less in the number of vacancies is considered as "even".

4.6 Technical skills in demand

Every job has unique characteristics and skill requirements. Therefore, this rapid assessment identified the technical skills required by each job vacancy (figure 14). The top five technical skills that were most in demanded by industry are:

1. Back-end development for Windows and Linux, where employers expect jobseekers to have the ability to develop systems on these two operating systems.
2. Database skills, especially SQL and MySQL.
3. Front-end development, mainly using HTML and CSS.
4. Skills in using design programmes such as InDesign, CorelDRAW and Photoshop.
5. Mobile programming for Android and iOS.

Figure 14. ICT technical skills required by industry

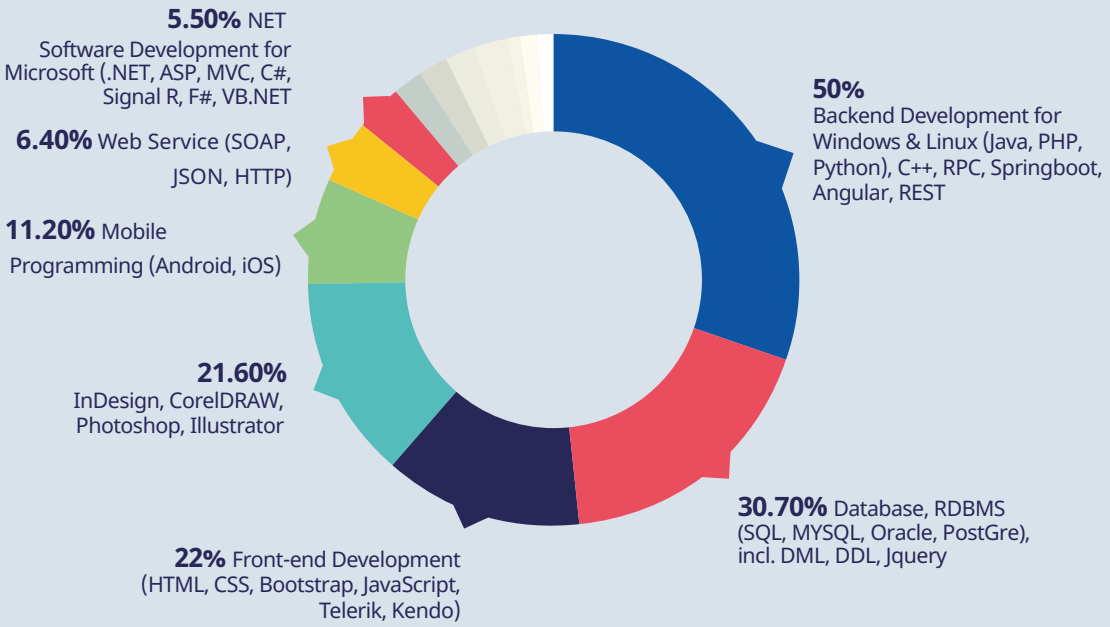


Table 6 below provides details on the number of job vacancies that require each technical skill. This rapid assessment covered 436 job vacancies, but as shown in table 6, a single job vacancy can require several technical skills. Thus, jobseekers must possess and job training institutions are expected to teach not only one but several skills in order to increase employability and improve the possibility of finding a job.

Table 6

Number of job vacancies requiring each ICT technical skill

Required technical skill	No. of vacancies[1]	% of vacancies[1]
Back-End Development for Windows & Linux (Java, PHP, Python), C++, RPC, Spring Boot, Angular, REST	218	50.0%
Database, RDBMS (SQL, MYSQL, Oracle, PostGre), incl. DML, DDL, Jquery	134	30.7%
Front-End Development (HTML, CSS, Bootstrap, JavaScript, Telerik, Kendo)	96	22.0%

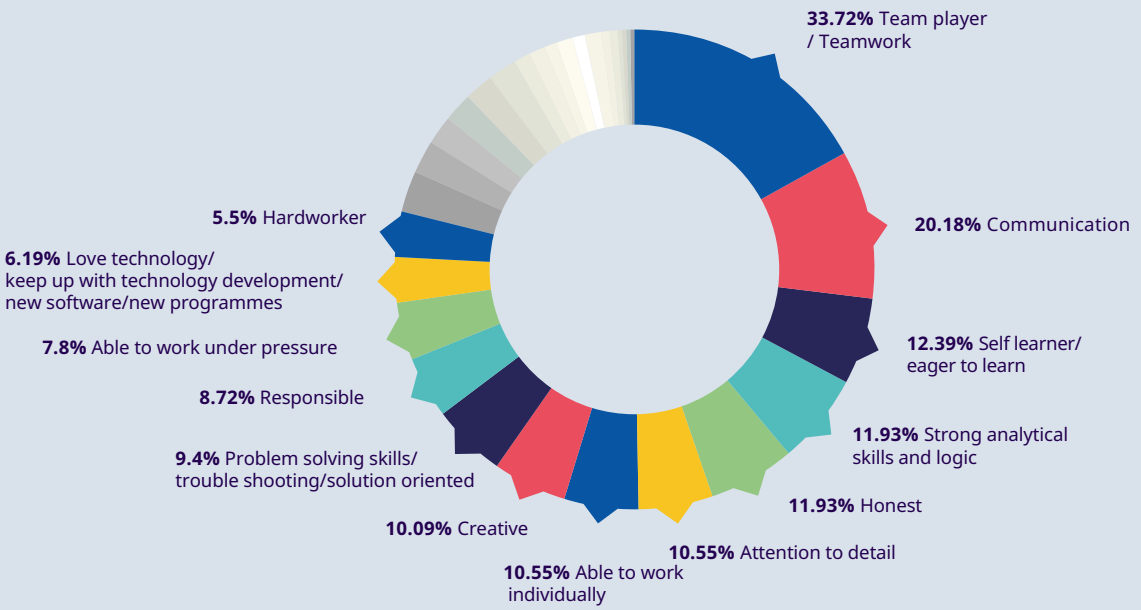
Required technical skill	No. of vacancies[1]	% of vacancies[1]
InDesign, CorelDRAW, Photoshop, Illustrator	94	21.6%
Mobile Programming (Android, iOS)	49	11.2%
Web Service (SOAP, JSON, HTTP)	28	6.4%
.NET Software Development for Microsoft (.NET, ASP, MVC, C#, Signal R, F#, VB.NET	24	5.5%
Information Security, incl. Firewall, CCNA, SSL Certificate, VPN, IPS, IDS, TCP/IP, Licensing software, ARP	18	4.1%
SEO/SEM	16	3.7%
Usability testing (mobile & web), performance testing	14	3.2%
ERP Program (SAP)	12	2.8%
Gsuite, OOP, Jasper Report, GRAILS, CI, Spring, Hibernate, React Native, Laravel	11	2.5%
Website analytics (Google Analytics, Google Search Console)	7	1.6%
Payment gateways, P2P systems	7	1.6%
Installation and system maintenance	1	0.2%

[1] Vacancies can require more than one skill. The total number of vacancies is 436. The percentages in this table are based on that total number, which is why they add up to more than 100 per cent.

4.7 Non-technical/soft skills in demand

For each published job vacancy, this rapid assessment also identified the required non technical skills (also known as "soft skills"). Figure 14 shows the percentage of ICT job vacancies that were seeking each of the non technical skills identified.

Figure 15. Non-technical skills required of ICT jobseekers by industry



It is apparent from the graph above that the ability to work in team, communication skills, willingness to learn, analytical skills and honesty are non-technical skills currently required from ICT workers. Just as the technical skills, a single job vacancy may ask for more than one non-technical skill. This is described in detail in Table 7.

Table 7

Number of ICT job vacancies requiring each non-technical skill

Non-technical skills	No. of vacancies[1]	% of vacancies[1]
Team player / Teamwork	147	33.72%
Communication	88	20.18%
Self-learner / Eager to learn	54	12.39%

Non-technical skills	No. of vacancies[1]	% of vacancies[1]
Strong analytical skills and logic	52	11.93%
Honest / Has integrity	52	11.93%
Attention to detail	46	10.55%
Able to work individually	46	10.55%
Creative	44	10.09%
Problem solving skills / Trouble shooting / Solution-oriented	41	9.40%
Responsible	38	8.72%
Able to work under pressure	34	7.80%
Love technology / Keep up with technology development/new software/new programmes	27	6.19%
Hardworker / Energetic	24	5.50%
Able to meet deadline/have time management	23	5.28%
Proactive / Have initiative	21	4.82%
Interpersonal skills	19	4.36%
Fast learner	16	3.67%
Innovative	13	2.98%
Energetic / Can do attitude	13	2.98%
Loyal / High dedication / Integrity	12	2.75%
Communication in English	7	1.61%
Excellent in documentation/project document/develop guidance	6	1.38%
Good presentation skills	6	1.38%
Organized	5	1.15%
Customer-oriented	5	1.15%
Readiness to travel	4	0.92%
Have good planning	3	0.69%
Artistic	3	0.69%
Responsive / Flexible / Adaptive	2	0.46%
Website communication / Social media	1	0.23%
Well behaved / Polite	1	0.23%
High standards	1	0.23%

[1] Vacancies can require more than one skill. The total number of vacancies is 436. The percentages in this table are based on that total number, and therefore add up to more than 100 per cent.

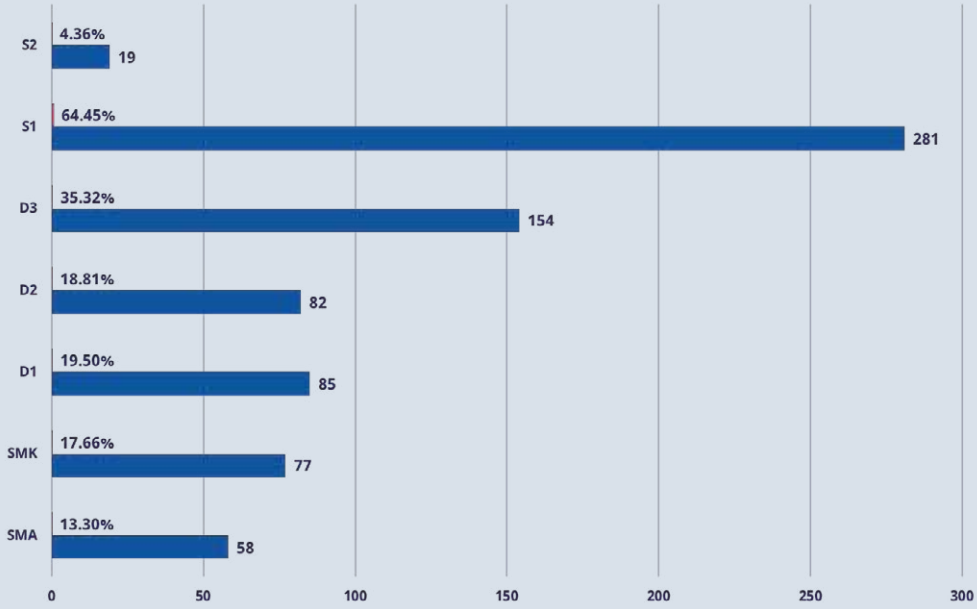
4.8 Language skill demands

This rapid assessment finds that only 20 per cent of the vacancies indicated that they required workers with certain foreign language skills. Within this 20 per cent of vacancies, employers sought skills in the following languages: English (95 per cent), Japanese (3 per cent) and Mandarin (2 per cent).

4.9 Required educational background

This rapid assessment found that nearly 40 per cent of available job vacancies require propective ICT workers to have a minimum education attainment of a bachelor's degree (S1). About 20 per cent of vacancies are available for prospective workers who have attained a Diploma-3, and the rest require that workers have senior high school (SMA), vocational high school (SMK), Diploma-1 or Diploma-2 certificate[1]. Only a few job vacancies (less than 5 per cent) require at least a masters degree (S2).

Figure 16. Minimum level of educational attainment required by ICT job vacancies[1] (%)

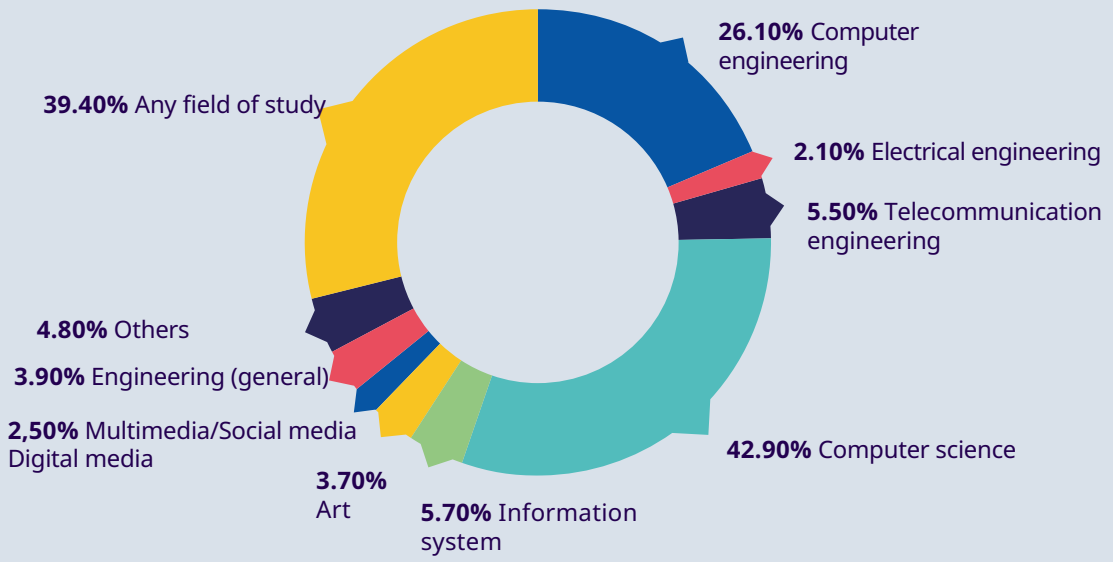


[1] S2 = masters degree; S1 = bachelor's degree; D3 = Diploma-3; D2 = Diploma-2; D1 = Diploma-1; SMK = vocational high school; SMA = senior high school. Vacancies can accept applicant from more than one level of education attainment. The total number of vacancies is 436. The percentages in this chart are based on that total number, which is why they add up to more than 100 per cent.

[1] Diploma 1, 2 and 3 are titles given to those who have completed higher education for 1 year, 2 years and 3 years respectively. There is also a Diploma 4 in the Indonesian education system, although this requirement was not identified by this assessment. Graduates of diploma studies are given the title of associate (ahli madya in Indonesian) and their studies will have focused on practices and applied science; while graduates of bachelor studes are given the title of bachelor (sarjana in Indonesian) and their studies will have focused more on theory.

In addition to providing a minimum educational attainment requirement, many job vacancies specified the fields of study. Graduates of who have studied Computer Science are in the greatest demand among employers (42.9 per cent of vacancies), followed by "any major" (39.4 per cent), Computer Engineering (26.10 per cent), Information Systems (5.70 per cent) and Telecommunication Engineering (5.5 per cent), as shown in figure 17 below.

Figure 17. Fields of study required in ICT jobs vacancies[1] (%)



[1] Vacancies can accept applicant from more than one field of study. The total number of vacancies is 436. The percentages in this chart are based on that total number, which is why they add up to more than 100 per cent.

4.10 Industry demand for multi-skilled workers

Figure 4 above showcases the roles in the ICT sector that are mostly commonly offered by employers. This section further examines the multiple skills demanded by employers for the top six roles, in order to help jobseekers develop the skills that are essential for the positions they want:

JOB VACANCY 1: IT SUPPORT/STAFF COMPUTER / MAINTENANCE / HELPDESK

Educational attainment	SMA/SMK, diploma, bachelor's, masters Fields of study: Computer Engineering, Computer Science
Technical skills	▶ Understanding Windows or Linux (Java, PHP, Python); ▶ Front-end development skills (HTML, CSS); ▶ Some jobs require understanding of mobile programming and databases.
Non-technical skills	Analytical skills, able to work in a team but able also to work independently, able to communicate well, and honest.
Language skills	Mostly Indonesian, while a small proportion require English.

JOB VACANCY 2: IT SYSTEM PROGRAMMER / SYSTEM ANALYST

Educational attainment	Diploma, bachelor's Fields of study: Computer Engineering, Computer Science, Telecommunication Engineering
Technical skills	▶ Front-end development skills (HTML, CSS, Bootstrap, JavaScript); ▶ Back-end development for Windows or Linux (Java, PHP, Python, C++, REST, API); ▶ Databases (SQL, MySQL, Oracle)
Non-technical skills	Able to work in a team, willing to learn, able to communicate well, analytical skills, and honest
Language skills	Indonesian and English

JOB VACANCY 3: IT WEB DESIGNER AND DEVELOPER

Educational attainment	SMA/SMK, diploma, bachelor's, masters Fields of study: Computer Science, any field
Technical skills	▶ Front-end development skills (HTML, CSS, Bootstrap, JavaScript); ▶ Back-end development for Windows or Linux (Java, PHP, Python, C++, REST, API); ▶ Design skills (Photoshop, CorelDRAW, InDesign, Illustrator); ▶ Databases (SQL, MySQL)
Non-technical skills	Able to work in a team, communication skills, willing to learn, honest
Language skills	Indonesian and English

JOB VACANCY 4: MOBILE APP DEVELOPER

Educational attainment	SMA/SMK, diploma, bachelor's, masters Fields of study: Computer Science, Computer Engineering, any field
Technical skills	▶ Mobile programming (Android, IOS); ▶ Front-end development (HTML, CSS, Bootstrap, JavaScript); ▶ Back-end development for Windows or Linux (Java, PHP, Python, C++, REST, API); ▶ Web service (SOAP, JSON, HTTP), ▶ Databases (SQL, MySQL)
Non-technical skills	Able to work in a team, willing to learn, good communication
Language skills	Indonesian and English

JOB VACANCY 5: SOCIAL MEDIA OFFICER

Educational attainment	SMA/SMK, diploma, bachelor's Fields of study: Computer Science, Computer Engineering, Communication, any field
Technical skills	▶ SEO/SEM; ▶ Design (Photoshop, CorelDRAW, InDesign, Illustrator); ▶ Back-end development for Windows or Linux (Java, PHP, Python, C++, REST, API)
Non-technical skills	Able to work in a team, communication skills, creative, analytical skills
Language skills	Indonesian and English

JOB VACANCY 6: CREATIVE CONTENT / CREATIVE DESIGNER

Educational attainment	SMA/SMK, diploma, bachelor's Fields of study: Art/Design, Multimedia, Computer Science, any field
Technical skills	▶ Design skills (Photoshop, CorelDRAW, InDesign, Illustrator)
Non-technical skills	Able to work in a team, good communication, attention to detail, creative, honest
Language skills	Indonesian and English

4.11 Salary/wage of ICT workers

This rapid assessment sought to identify the salary/wage offered by the employers in the ICT job vacancies analysed. However, 64 per cent of the vacancies did not specify the salary/wage offered. Among the 436 vacancies analysed:

- 17 per cent offered a salary of 3.01–7 million rupiahs per month;
- 16 per cent offered less than 3 million rupiahs; 2.1 per cent offered 7–10 million rupiahs; and
- only 1.2 per cent offered salaries of more than 10 million rupiahs.

Because the Covid-19 pandemic has had economic impacts on business and industry, the rapid assessment also compared the salaries offered in vacancies before and during the Covid-19 pandemic, and the results can be seen in table 8 below.

Table 8

Salaries/wages offered in ICT job vacancies before and during the Covid-19 pandemic (% of vacancies)

Monthly salary/wage	Pre-Covid-19 (Jan.–Feb. 2020)	During Covid-19 (Apr.–May 2020)	Overall
< IDR3 million	22.3%	7.7%	16.1%
IDR3.01–7 million	18.2%	15.9%	17.2%
IDR7.01–10 million	–	4,9%	2.1%
> IDR10 million	1.2%	1.1%	1.2%
Not available	58.3%	70.3%	63.4%

IDR = Indonesian rupiah; – = nil.

It is apparent that both before and during the pandemic, information on the salaries/wages to be paid to ICT workers is rarely mentioned in job vacancies. Among vacancies that do provide salary information, there was a decrease during the pandemic of job vacancies with salaries of less than 7 million rupiahs, and there has been an increase in vacancies with salaries of 7.01–10 million rupiahs. This may be due to a need for workers with more experience who are able to work independently at home. However, given that a majority of ICT job vacancies do not provide salary information, it is difficult to fully analyse any potential trends related to payment in the ICT sector.

5

ANALYSIS OF ICT SKILLS TRAINING AT BBPLK BEKASI

Analysis of ICT skills training at BBPLK Bekasi

The ILO Jakarta Office collaborates with the Ministry of Manpower on skills development initiatives and programmes. One of these collaborations is the strengthening of the BBPLK Bekasi vocational training centre, especially its ICT courses. For this reason, the rapid assessment examined the extent to which the technical skills taught at BBPLK Bekasi meet the needs of the ICT sector by analysing data from the identified job vacancies and juxtaposing these data with the skills training programmes offered.

BBPLK Bekasi offers 12 skills training programmes on ICT, namely:

- Client Server Programming
- Graphic Design
- Computer Technician
- Mobile Programming
- Database Programming
- Movie Animation
- Web Developer
- IT Software Solution for Business
- Network Professional
- Cloud Computing
- Animator, and
- Warehouse (see figure 18).

These 12 programmes are juxtaposed with each identified job title/role in the ICT sector in table 9.

Figure 18. Infographic of ICT training programmes at BBPLK Bekasi

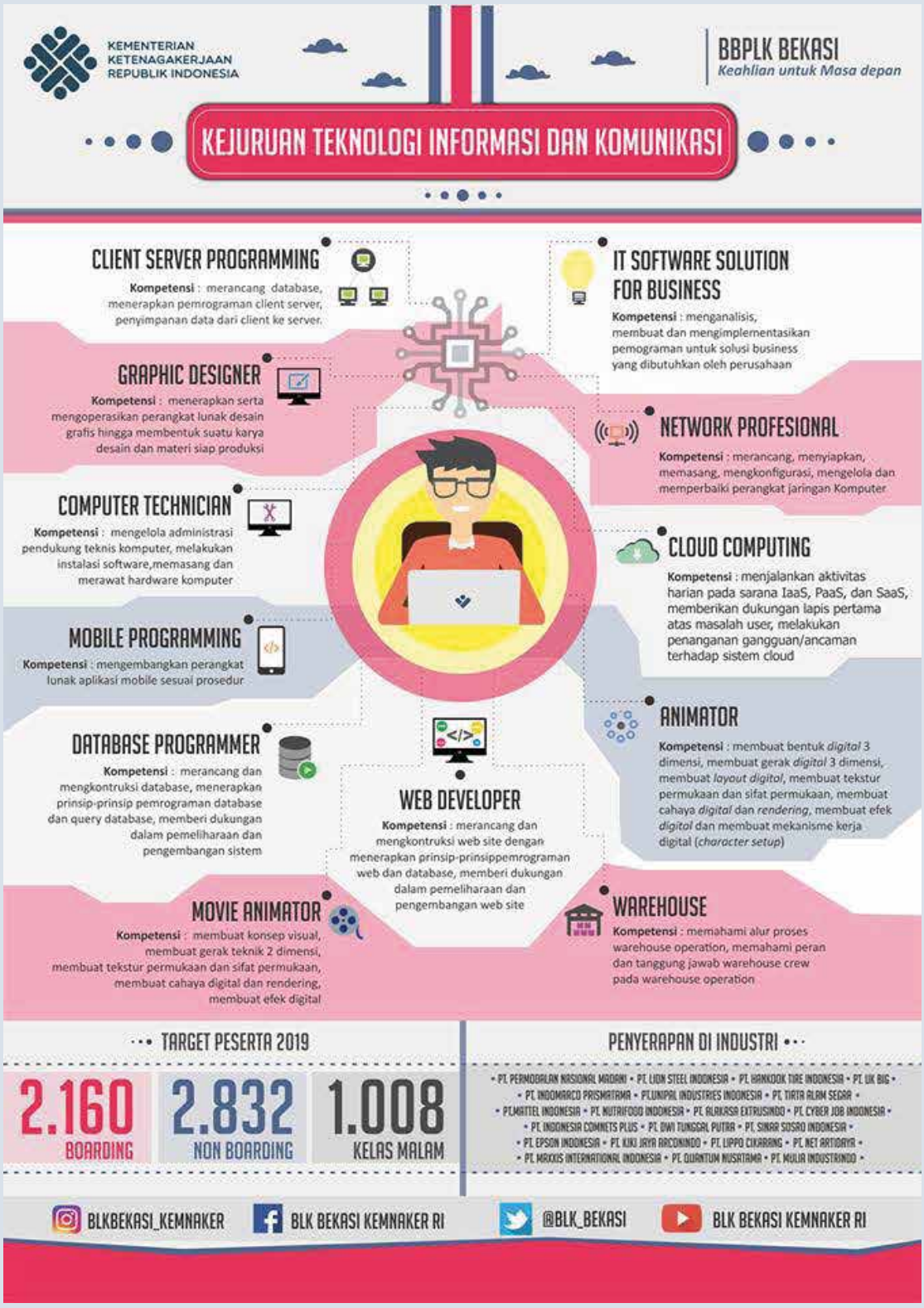


Table 9 - A

Applicability of Bekasi BBPLK training programmes to ICT sector job vacancies, by job title and number of vacancies

Job title(s)	No. of vacancies (n=436)	% of vacancies	Skills training programme					
			IT Software Solution for Business	Client Server Programming	Web Developer	Network Professional	Cloud Computing	Mobile Programming
IT Support / Computer Support / Maintenance / Help Desk	68	16%	–	–	–	√	√	–
IT System Programmer / Developer / Admin / System Analyst (Java, iOS)	63	14%	√	√	√	√	√	√
IT Web Designer & Developer (e.g., PHP, Magento, WordPress)	44	10%	√	√	√	–	–	–
Social Media / Digital / Multimedia Admin / Officer / Marketing / SEO Specialist / Manager	36	8%	–	–	√	–	–	–
Creative Content / Content Creator / Creative Designer / Video Editor / Graphic Designer	35	8%	–	–	–	–	–	–
Mobile App Developer / Android Developer / App Engineer	33	8%	√	√	–	–	–	√
IT Software Engineer / Quality Assurance / Quality Control / Tester / Developer (Odoo, Oracle, Angular)	27	6%	√	√	√	–	–	√
Front-End Developer / Engineer / Web Programmer	16	4%	√	–	√	–	–	–
IT Network / Network Engineer / Network Administrator	15	3%	–	–	–	√	√	–
Network Programmer / Developer (e.g., .NET, ERP, ASP, C#)	15	3%	√	√	–	√	√	–
Back-End Developer / Programmer / Engineer	12	3%	√	√	√	–	–	√
Database / Storage / Server Engineer / Administrator	10	2%	–	–	–	√	√	–
Full Stack Engineer / Web Programmer / Developer	10	2%	√	√	√	–	–	√
UI/UX Developer / Designer	10	2%	–	–	–	–	–	–
IT Security / Security Engineering / Security Programmer / Cyber Security	9	2%	–	–	–	√	√	–
IT Consultant (SAP, Bootcamp)	7	2%	–	–	–	–	–	–
Developer / Programmer / Engineer – Android	6	1%	√	√	–	–	–	√

Job title(s)	No. of vacancies (n=436)	% of vacancies	Skills training programme					
			IT Software Solution for Business	Client Server Programming	Web Developer	Network Professional	Cloud Computing	Mobile Programming
Developer Unity / C++ / Python / Android	5	1%	√	√	–	–	–	√
Account / Sales Executive	4	1%	–	–	–	–	–	–
IT Project Manager	4	1%	–	–	–	–	–	–
IT / Computer Teacher	3	1%	–	–	–	–	–	–
Developer / Programmer / Engineer – Delphi	2	0%	√	√	√	–	–	–
Division Manager – VMware	1	0%	–	–	–	√	√	–
Finance Engineer	1	0%	–	–	–	–	–	–
No. of job vacancies requiring skills learned in the training programme:			**233**	**217**	**210**	**181**	**181**	**156**
% of job vacancies requiring skills learned in the training programme:			**53%**	**50%**	**48%**	**42%**	**42%**	**36%**
No. of job titles requiring skills learned in the training programme:			**11**	**10**	**8**	**7**	**7**	**7**

Table 9 - B

Applicability of Bekasi BBPLK training programmes to ICT sector job vacancies, by job title and number of vacancies

Job title(s)	No. of vacancies (n=436)	% of vacancies	Skills training programme						
			Graphic Designer	Computer Technician	Database Programmer	Animator	Movie Animator	Warehouse	Other
IT Support / Computer Support / Maintenance / Help Desk	68	16%	–	√	–	–	–	–	–
IT System Programmer / Developer / Admin / System Analyst (Java, iOS)	63	14%	–	–	–	–	–	–	–
IT Web Designer & Developer (e.g., PHP, Magento, WordPress)	44	10%	√	–	–	–	–	–	–
Social Media / Digital / Multimedia Admin / Officer / Marketing / SEO Specialist / Manager	36	8%	√	–	–	–	–	–	–
Creative Content / Content Creator / Creative Designer / Video Editor / Graphic Designer	35	8%	√	–	–	√	√	–	–

Job title(s)	No. of vacancies (n=436)	% of vacancies	Skills training programme						
			Graphic Designer	Computer Technician	Database Programmer	Animator	Movie Animator	Warehouse	Other
Mobile App Developer / Android Developer / App Engineer	33	8%	–	–	–	–	–	–	–
IT Software Engineer / Quality Assurance / Quality Control / Tester / Developer (Odoo, Oracle, Angular)	27	6%	–	–	√	–	–	–	–
Front-End Developer / Engineer / Web Programmer	16	4%	√	–	–	–	–	–	–
IT Network / Network Engineer / Network Administrator	15	3%	–	√	–	–	–	–	–
Network Programmer / Developer (e.g., .NET, ERP, ASP, C#)	15	3%	–	–	–	–	–	–	–
Back-End Developer / Programmer / Engineer	12	3%	–	–	√	–	–	–	–
Database / Storage / Server Engineer / Administrator	10	2%	–	–	√	–	–	–	–
Full Stack Engineer / Web Programmer / Developer	10	2%	–	–	√	–	–	–	–
UI/UX Developer / Designer	10	2%	√	–	–	–	–	–	–
IT Security / Security Engineering / Security Programmer / Cyber Security	9	2%	–	–	√	–	–	–	–
IT Consultant (SAP, Bootcamp)	7	2%	–	–	–	–	–	–	–
Developer / Programmer / Engineer – Android	6	1%	–	–	–	–	–	–	–
Developer Unity / C++ / Python / Android	5	1%	–	–	–	–	–	–	–
Account / Sales Executive	4	1%	–	–	–	–	–	–	√
IT Project Manager	4	1%	–	–	–	–	–	–	√
IT / Computer Teacher	3	1%	–	–	–	–	–	–	√
Developer / Programmer / Engineer – Delphi	2	0%	–	–	–	–	–	–	–
Division Manager – VMware	1	0%	–	–	√	–	–	–	–
Finance Engineer	1	0%	–	–	–	–	–	–	√
No. of job vacancies requiring skills learned in the training programme:			**141**	**83**	**69**	**35**	**35**	**0**	**12**
% of job vacancies requiring skills learned in the training programme:			**32%**	**19%**	**16%**	**8%**	**8%**	**0%**	**3%**
No. of job titles requiring skills learned in the training programme:			**5**	**2**	**6**	**1**	**1**	**0**	**4**

Table 9 shows the extent to which the 12 skills training programmes offered by BBPLK Bekasi provide the skills demanded in ICT sector job vacancies. The training programmes with the greatest applicability to the job vacancies in the sector are as follows:

- IT Software Solutions for Business – applicable to 53 per cent of job vacancies;
- Client Server Programming – 50 per cent of job vacancies;
- Web Developer – 48 per cent of job vacancies;
- Professional Network – 42 per cent of job vacancies;
- Cloud Computing – 42 per cent of job vacancies;
- Mobile Programming – 36 per cent of job vacancies;
- Graphic Designer – 32 per cent of job vacancies; and

However, one must keep in mind that most job vacancies require more than one skill, which means that a person will need to undergo more than one type of training to meet all the skills requirements. Some examples are given below:

- IT support job vacancies require the skills gained from the Network Professional, Cloud Computing and Computer Technician training programmes.
- IT system job vacancies require the skills gained from the IT Software Solution for Business, Client Server Programming, Web Developer, Network Professional, Cloud Computing, and Mobile Programming training programmes
- IT web designer job vacancies require the skills gained from the IT Software Solutions for Business, Client Server Programming, Web Developer and Graphic Designer training programmes.
- Social media officer job vacancies require the skills gained from the Web Developer and Graphic Designer training programmes.
- Creative content/graphic designer job vacancies require the skills gained from the Graphic Designer, Animator, and Movie Animator training programmes.

Based on Indonesian Government policy, a person can only attend one training per year at a VTC/BBPLK. Therefore, under this policy, a person cannot participate in the multiple training programmes needed to develop the skills required by certain roles/types of work in the ICT sector. Given this, BBPLK Bekasi needs to provide direction to training participants regarding the roles/types of work they can target after they have completed a particular ICT training. Information of this sort could also be provided on the BBPLK Bekasi's training website[2]. In addition, the website also needs to be equipped with information on contact details, training locations and training schedules in order for Indonesians to be able to take advantage of skills development networks throughout the country.

All training at VCTs/BBPLKs throughout Indonesia can be attended by Indonesian citizens aged no less than 18 years who have passed the admission test. There are no prior educational attainment requirements. Nevertheless, most of the training participants at BBPLK Bekasi are SMA/SMK graduates[3]. Therefore, the next chapter describes the job vacancies available to SMA/SMK graduates based on the findings of the rapid assessment.

[2] The website can be viewed at: https://blkbekasi.kemnaker.go.id/
[3] Presented by Ministry of Manpower at the validation workshop for this rapid assessment, 21 July 2020.

6

JOB VACANCIES OPEN TO SMA/SMK GRADUATES

Job vacancies open to SMA/SMK graduates

This rapid assessment brings together an accounting of the technical, non-technical and language skills demanded by the ICT sector, and focuses on the ICT training programmes at BBPLK Bekasi with the aim of providing direction to SMA/SMK graduates in looking for ICT jobs. The tables in this chapter show the skills required for select roles in the ICT sector, as well as existing gaps and proposed skills training that could be offered. The ICT roles were selected after taking into account the availability of job vacancies and the degree to which existing training programmes develop the skills required for the role.

Based on the findings of the rapid assessment, general high school (SMA) and vocational high school (SMK) graduates have to compete with jobseekers who hold diplomas or bachelor's degrees, which can put them at a significant disadvantage in the job market. However, roles that involve more routine work or short-term project work usually require a workforce of SMA/SMK graduates.

The rapid assessment finds there at least three ICT jobs that SMA/SMK graduates could secure by optimizing the existing ICT training programmes of BBPLK Bekasi. These are as follows:

- IT support/helpdesk
- Graphic designer/content creator
- IT web designer.

At present, an SMA/SMK graduate would need to go through three or four BBPLK Bekasi training programmes to gain all of the necessary skills to secure employment in any of these three roles, and as noted above, this is not feasible under current government policy. But by combining elements from existing training programmes into new programmes optimized for these roles, jobseekers could gain the skills they need through one course of just a few months' duration. By using existing materials and curricula, such new training programmes could be created with minimal expense and effort.

Tables 10–12 below cover each of these roles, presenting the required technical skills that are currently taught by BBPLK Bekasi training programmes; other technical skills identified by employers; and required non-technical skills. Each table also presents a brief overview of the potential new training programme that could be developed using existing curricula to specifically train SMA/SMK graduates for these three roles.

In addition, there are additional ICT jobs that could be made accessible to SMA/SMK graduates through the creation of two new vocational training programmes: (i) Java Developer and (ii) Front End Developer. Tables 13 provides a brief overview of what these new training programmes might entail and the job opportunities that they might open up to graduates.

Job vacancy 1 – IT support/helpdesk

IT support/helpdesk job vacancies were found in almost all cities covered by the rapid assessment, as shown in figure 19, although a majority are located in Jakarta (53 per cent), followed by other cities outside Java (9 per cent), Yogyakarta (7 per cent), and other cities on Java island (7 per cent).

Figure 19. IT support/helpdesk job vacancies by location

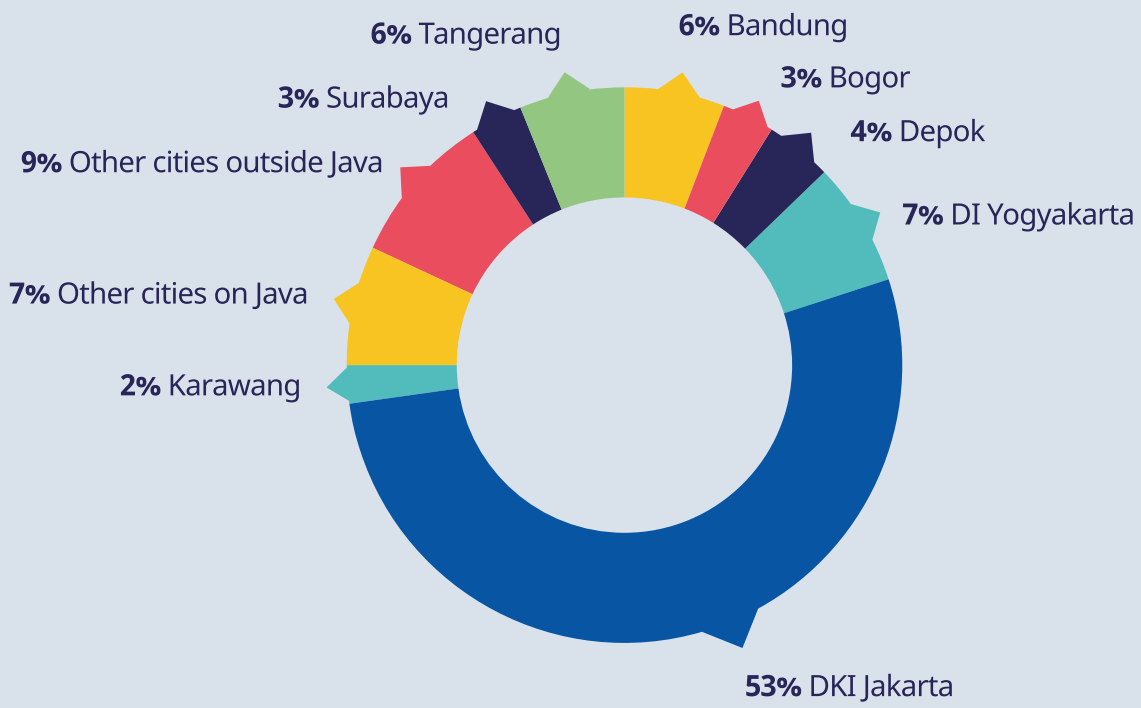


Table 10 below summarizes the technical and non-technical skills required to be able to fill an IT support/helpdesk job opening; the relevant training programmes already in place at BBPLK Bekasi; as well as presenting a brief summary of a proposed VTC training programme specific to the needs to the role.

Table 10

IT support/helpdesk jobs: Required technical and non-technical skills, current VTC training programmes, and proposed VTC training programme

Current VTC training programmes & relevant skills provided			Additional skills identified by employers / Proposed new VTC programme	Non-technical skills needed
Network professional	Cloud Computing	Computer Technician		
Skills in designing, preparing, installing, configuring, managing and repairing computer network devices.	Skills in: ▸ performing daily activities on recommended Laas, PaaS, SaaS; ▸ providing first-tier support for users' problems; ▸ handling cloud system interference / threats.	Skills in: ▸ managing computer technical support administration; ▸ installing software; ▸ installing and maintaining computer hardware.	**Additional skills identified by employers:** ▸ Microsoft Office ▸ preparing for online meetings/ video conferences for business needs. **Proposed new VTC programme:** IT Support/Helpdesk (Troubleshooting of Common Computer Problems) **Competences to be learned:** ▸ Act as a computer technician who can support the company's information and communication systems operations, including online operations and networks (including cloud computing). ▸ Have Java, PHP, Python, HTML, CSS skills. ▸ Understand how computers and the internet work; the process of installing applications and operating systems (Windows & Linux); MS Office (standard) to help general offices; router settings & office network (LAN) installations. ▸ Able to solve common computer service problems (computer cannot turn on, not connected to the internet, applications fail, computer viruses, etc.). **Training takes 1–3 months.**	▸ Teamwork skills ▸ Problem analysis skills ▸ Communication skills ▸ Skills to work independently ▸ Honest ▸ Good Indonesian language skills.

Job vacancy 2 – Graphic designer/content creator

Job vacancies for graphic designers/content creators (the fifth-most in-demand ICT job) are most commonly offered in Jakarta (43 per cent) and Yogyakarta (31 per cent), but are also available in several other cities, as shown in figure 20.

Figure 20. Graphic designer/content creator job vacancies by location

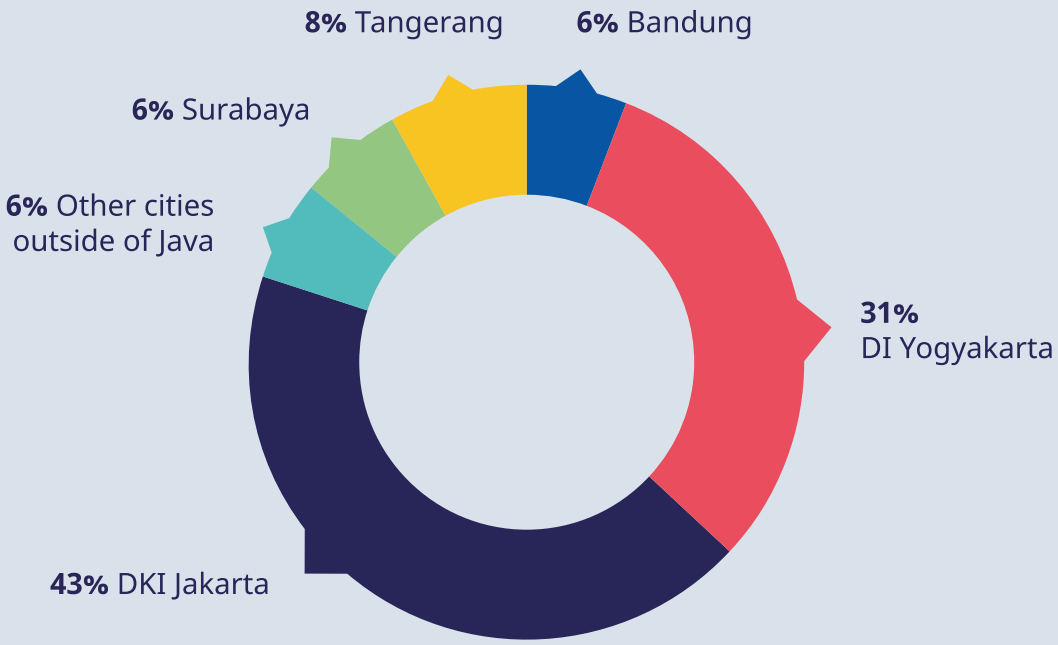


Table 11 below summarizes the technical and non-technical skills required to be able to fill a graphic designer/content creator job opening; the relevant training programmes already in place at BBPLK Bekasi; as well as presenting a brief summary of a proposed VTC training programme specific to the needs to the role.

Table 11

Graphic designer/content creator jobs: Required technical and non-technical skills, current VTC training programmes, and proposed VTC training programme

Current VTC training programmes & relevant skills provided			Additional skills identified by employers / Proposed new VTC programme	Non-technical skills needed
Graphic Designer	Animator	Movie Animator		
The skills in applying and operating graphic design software to generate design work and create ready-for-production materials.	Skills in: ▶ creating 3-dimensional digital shapes; ▶ 3-dimensional digital motion; ▶ digital layouts; ▶ surface textures and surface properties; ▶ digital lighting and rendering; ▶ digital effects and digital working mechanisms (character setup).	8 Skills in: ▶ creating visual concepts; ▶ 2-dimensional engineering motion; ▶ surface texture and surface properties; ▶ digital lighting and rendering; ▶ digital effects.	**Proposed new VTC programme: Graphic Designer/Content Creator.** **Competencies to be learned:** ▶ Able to communicate with clients to understand their needs; translate these needs into a creative graphic design as unique and interesting works of art, either in 2 or 3 dimensions and in digital forms, including options for animation and digital motion. ▶ Have digital design skills (Photoshop, CorelDRAW, InDesign, Illustrator) and able to practice them in a real project. ▶ Design marketing media (posters, social media content); design attractive and creative logos, packaging, stickers; and able to use editing applications such as Adobe Illustrator and Photoshop. **Training takes 2–4 months.**	▶ Teamwork skills ▶ Good communication skills with clients ▶ Attention to detail ▶ Creativity ▶ Honesty ▶ Indonesian and English language skills.

Job vacancy 3 – IT web designer

IT web designer ranks as the third-most in-demand jobs in the ICT sector based on the number of job vacancies advertised. These job vacancies were found in almost all cities covered by the rapid assessment with significant numbers in most cities. As with other roles, the largest number of vacancies were found in Jakarta, but these account for a much lower proportion (25 per cent) than with other roles, suggesting opportunities are widespread in Indonesia.

Figure 21. IT web designer job vacancies by location

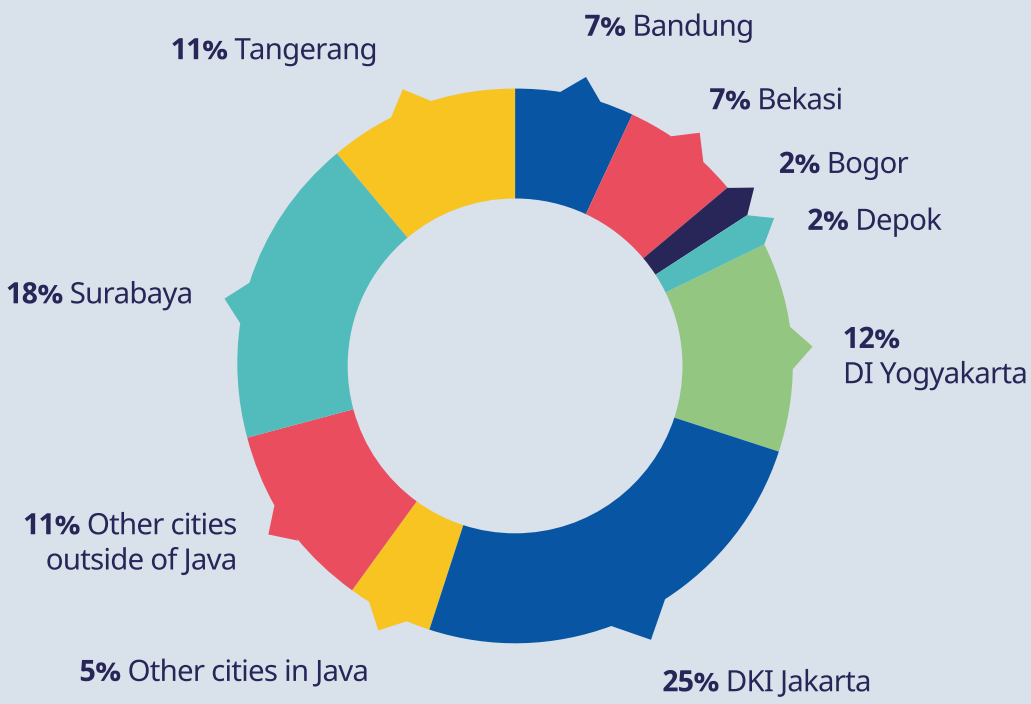


Table 12 below summarizes the technical and non-technical skills required to be able to fill a graphic designer/content creator job opening; the relevant training programmes already in place at BBPLK Bekasi; as well as presenting a brief summary of a proposed VTC training programme specific to the needs to the role.

Table 12

IT web designer jobs: Required technical and non-technical skills, current VTC training programmes, and proposed VTC training programme

Current VTC training programmes & relevant skills provided				Additional skills identified by employers / Proposed new VTC programme	Non-technical skills needed
IT Software Solutions for Business	**Client Server Programming**	**Web Developer**	**Graphic Designer**		
Skills in analysing, creating and implementing programmes for business solutions needed by companies.	Skills in: ▸ designing databases; ▸ implementing ▸ client server programmes; ▸ data storage from client to server.	Skills in: ▸ designing and constructing websites by applying the principles of web and database programming; ▸ providing support ▸ in website maintenance and development.	Skills in implementing and operating graphic design software to generate design work and create ready-for-production materials	**Additional skills identified by employers:** ▸ Wireframing **Proposed new VTC programme:** IT Web Designer **Competences to be learned:** ▸ Ability to communicate with clients to understand their needs, and translate those needs into a business solution design in the form of a website, including solutions for database and secure data storage needs, with friendly features and designs to use. ▸ Skills for front-end development (HTML, CSS, Bootstrap, JavaScript); ▸ Skills for back-end development for Windows or Linux (Java, PHP, Python, C++, REST, API); ▸ Design skills (Photoshop, etc.); ▸ Databases (SQL, MySQL); ▸ Continuously learning to follow the development of website technology, both in Indonesian and English. **Training takes 1-3 months.**	▸ Teamwork skills ▸ Communication skills (particularly with clients) ▸ Willingness to learn ▸ Honest ▸ Indonesian and English language skills

Using data-mining methods, the rapid assessment of ICT job vacancies in Indonesia found that the most in-demand technical skill in the ICT sector is knowledge of the Java programming language (Gunawan, Oktavianto, and Rumiati, unpublished). For this reason, new training programmes built around teaching Java programming should be considered for BBPLK Bekasi. Such programmes could potentially provide SMA/SMK graduates with opportunities to secure ICT job opportunities that would otherwise be beyond their grasp.

Table 13 presents brief overviews of two new training programmes that could be provided by BBPLK Bekasi.

Table 13

Proposed new skills development programmes to meet ICT sector demand

Programme title	Job opportunities	Scope of learning	Rationale of proposal	Learning time
Java Developer	▸ Java Developer ▸ Mobile Programmer (Android) ▸ Software Engineer ▸ Back End Developer	▸ Data structure; ▸ Creating applications using the popular Java framework (e.g., Spring Boot); ▸ Creating CRUD (create read update delete) applications using Java; ▸ Creating Android applications using a simple API.	Java is the most in-demand programming language. It means that many companies need Java programmers. Java is not only popularly used as a programming language to create Android applications, it can also be used as for back end programmes.	6–8 months (40 learning hours a week)
Front-End Developer	▸ JavaScript Developer ▸ Full Stack Developer ▸ Front-End Developer ▸ Web Designer & Developer	▸ In general, learning about how to create static and dynamic websites; ▸ How to create website animations; ▸ Learning HTML5, JavaScript and CSS3; and ▸ How to use front-end frameworks (e.g., Bootstrap 4 and Angular.js)	JavaScript ranks fourth among the most in-demand skills, and sixth among the most in demand programming languages/ frameworks. The JavaScript programming language is popularly used as a front end programming language, and JavaScript does not stand alone but is equipped with other programming/markup languages (e.g., HTML, CSS, etc.)	6–8 months (40 learning hours a week)

7

CONCLUSIONS AND RECOMMENDATIONS

Conclusions and recommendations

Conclusions

This rapid assessment collected ICT job vacancy data both before and during the Covid-19 pandemic hit Indonesia, and it finds that ICT job vacancies are still available even in the face of the pandemic. Based on the job vacancies assessed, the seven ICT roles that are the most in demand by industry in Indonesia are the following:

1. IT support / computer support / maintenance / helpdesk
2. IT system programmer / developer / system analyst
3. IT web designer and developer
4. Creative content / creative designer.
5. Mobile app developer
6. Social media / digital / multimedia / marketing / SEO specialist
7. IT software engineer / quality assurance / quality control / tester / developer

Many of these jobs are open to new jobseekers in the ICT sector (0–24 months of work experience), but there are also a few apprenticeship opportunities available. In addition, companies prioritize workers with experience and/or technical skills more than whether the applicants have certain educational backgrounds. For this reason, training programmes need to emphasize cooperation with industry to allow jobseekers and employers to benefit from each other.

In terms of skills, the top five of technical skills that are the most in demand in industry are:

1. back-end development
2. database skills
3. front-end development
4. programme design skills
5. mobile programming.

In addition, the top five of non-technical skills that are most commonly demanded by employers are:

1. teamwork skills
2. communication skills
3. willingness/eager to learn
4. strong analytical skills and logic
5. honesty/integrity.

Regarding language skills, English proficiency remains the most in-demand foreign language skill.

At present the greatest number of ICT job vacancies are available in Jakarta. The industry that is hiring the greatest numbers of ICT workers is the information and communication industry, followed by the trade, administrative support services, finance, manufacturing and professional services industries. With the increasing growth of internet access in Indonesia and as a result of the increasing quality of ICT human resources, it is hoped that more jobs in the ICT sector will be available outside Jakarta and in a greater variety of industries.

Recommendations

The following recommendations are addressed to BBPLK Bekasi in its capacity as a referral centre for ICT skills development in order to allow it to review its curriculum and offer training packages that match the demands of the labour market.

Industry needs for ICT skills are very dynamic, and shifts in skills demand need to be responded to quickly. For this reason, BBPLK Bekasi should organize regular evaluations of the curriculum for and organization of ICT skills training every six months, and track down BBPLK Bekasi graduates to find out how many have been absorbed into the ICT sector labour force. In addition, BBPLK Bekasi also needs to formulate joint programmes with target industries to be able to plan and implement the process of providing quality workers in accordance with industry needs at the right place, at the right time and in the appropriate number.

Because not all job vacancies are open to SMA/SMK graduates and there is a need to find solutions for quick job creation, there is a need to create the following training programmes: IT Support/Helpdesk, Graphic Designer/Creative Content, and Web Developer. These training programmes should be short-term initiatives with training periods of one to four months' duration. By using existing materials and curricula, these new training programmes could be created with minimal expense and effort. In addition, this assessment recommends the creation of two new medium-term training programmes (training period of 6–8 months) – Java Developer and Front-End Developer – which should be considered given their potential to expand SMA/SMK graduates access to a number of ICT sector jobs. These courses would enable VTCs to address the high levels of industry demand for skills related to the Java and JavaScript programming languages.

VTCs/BBPLK are intended to provide quality human resources for local industry. Therefore, it is necessary to understand the demands of each sector and in each region. Rapid assessment of skills needs using data mining methodology can effectively and efficiently provide a more detailed description of such needs.

BBPLK Bekasi already has a website to make it easier for jobseekers to access information on skills improvement. It is recommended that the website be equipped with information on contact details, training locations and training schedules to be able to take advantage of skills development networks throughout Indonesia. The website also needs to provide direction for the types of jobs participants can target after they have completed a particular ICT skills training.

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